AN ACCOUNT

OF

SURVEYS AND EXAMINATIONS,

WITH

REMARKS AND DOCUMENTS,

RELATIVE TO THE PROJECTED

CHESAPEAKE AND OHIO

AND

OHIO AND LAKE ERIE

CANALS.

BY JAMES SHRIVER.

"For my own part, I wish sincerely, that every door to that country (the west) may be set wide open, that the commercial intercourse with it may be rendered as free and easy as possible. This in my judgment, is the *best*, if not the *only* cement that can bind those people to us for any length of time—and we shall, I think, be deficient in foresight, if we neglect the means of effecting it." *Washington.*

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TO THE PUBLIC.

The manifestation by legislative acts, popular meetings, and general excitement throughout the country, of an imposing and growing interest in behalf of a canal connexion between the waters of the Chesapeake and those of the Ohio, induced the author of the annexed work, to devote some weeks of the past summer, to exploring the summit of the Alleghany mountain, where the chief obstacle to forming a continuous route for canal navigation between the Atlantic and Western states is supposed to exist. These examinations were made at the time, not for the purpose of publication, but to satisfy himself and a few friends, of the practicability of the project: he was subsequently encouraged to believe that the information which he had collected, might shed such light on the subject, as would materially aid in its accomplishment. Yielding to this persuasion, he made further surveys and observations, with a view of rendering the work in some degree worthy the public attention. These he now respectfully presents to the indulgence of the public, with the addition of sundry communications, and documents, containing much useful information. He claims no merit for the work, except what a zeal for the cause, and a faithful report of his labours deserve; looking to the accomplishment of this great design, as an ample reward for his trouble.

Baltimore, *January* 24, 1824.

AN

ACCOUNT OF SURVEYS.

Topographical Description.

As introductory to the main object of this work, a topographical description of a part of the country through which the contemplated canal is proposed to pass, may not be improper, or irrelevant to the subject. This portion of country lying between the waters of the Potomac and Youghagany, embracing the summit level, is but little known except to persons residing immediately within its limits. Public inquiry has, however, latterly, been much directed towards this quarter, and as it presents, perhaps, the only point where the greatly desired connexion of the eastern and western waters may be formed with facility, little doubt remains that before long careful surveys will be made of all its parts, and its geography will be as intimately understood, as that of the most thickly populated section. As, however, some time must necessarily elapse before such information,

much as it is demanded, can be obtained; it is believed the following brief description will be acceptable, if on no other account, as rendering more intelligible the accompanying map.

The face of the Country. The great massive range of mountains, which are known where the National road intersects them, as the Great and Little Savage mountain, Meadow mountain, Negro mountain, Keyser's and Winding ridges, preserve their general direction, and are readily traced, until they are broken, and disarranged by the streams emptying into the Potomac, and Youghagany rivers. The Great Savage mountain after being broken down by the Savage river, (which rises on the western side of this mountain, near the crossing of the National road) assumes again its lofty character, and under the several appelations of the Great Back-bone mountain, Clinch's mountain, Cumberland mountain, &c. continues its course southward, the general barrier between the Mississippi and Atlantic waters. A rather indistinct continuation of the Little Savage mountain, is known at the head of Deep creek as the Little Back-bone mountain, and is the ridge which divides the waters of that stream, and Crab-tree creek, which take their rise within one hundred perches of each other on its eastern and western sides: it is at this point a very inconsiderable ridge, and in its southward course soon becomes altogether extinct. The Meadow mountain terminates at the glade below the Narrows.—A spur or lateral branch of it, continuing to the Youghagany river bears the name of the Hoop-pole ridge. Nearly opposite the Meadow mountain appears the Roman-nose ridge, probably a continuation of Negro mountain,

Keyser's ridge, which presents the greatest point of elevation in the profile of the National road, is traced to the head of Bear creek, where it is lost in lateral spurs of inconsiderable extent; and lastly, the Winding ridge, a bold and well defined mountain, is broken by the Youghagany river, and loses its name at the point of disruption: the same ridge can, however, be traced still further southward under different names.

When viewed collectively, these mountains exhibit an extremely uneven and rugged country, presenting in some parts deep and narrow ravines, in others, interesting vallies and flats, of natural meadow lands; and not unfrequently surfaces composed entirely of rock. The soil is, consequently, of various qualities, many parts are barren and unproductive, but much good land producing grass and very fine timber, frequently occurs, lime stone districts, and sugar-tree lands, of great fertility, are not uncommon; a great portion of them although in a mountainous region, lie handsome for cultivation, and are susceptible of elegant and advantageous improvement. Naturally they may be considered as grazing lands of the best quality, and when improved produce well.

The glades, or natural meadows, which may be considered as the most remarkable, as well as the most interesting feature in this tract of country, are found extended as it were, on the very summit of the dividing mountains, many miles in every direction. The intervention of lateral spurs of the Great Backbone mountain and other hills, divide and separate them, producing distinct glades of various shapes and dimensions, all of which, however, possess in a great

degree the same general level,* and similar leading characteristics, they are known by different names: the two most prominent are the Green glade and the Youghagany glade. The former extends along Deep creek from its source six miles westward, a continuous scope of open meadow. It is bounded by spurs of different mountains, and from the extreme irregularity of its outline it is difficult to estimate its width, it may be assumed at from one eighth to one quarter of a mile. From the best data attainable, it is ascertained to have an area of about three thousand acres. This glade is remarkable for its very even and level surface, for its great fertility of soil, and for its being free from bushes or undergrowth of every kind. The surrounding and intervening hills are exclusively covered with a thick growth of yellow pine, from the evergreen appearance of which has arisen the name of the *Green glade.*

The Youghagany glade extends from the mouth to the source of the little Youghagany creek, nearly parallel with the Green glade from which it is separated by an inconsiderable ridge. The hills surrounding this glade are generally covered with a thin growth of white oak, others are entirely bald: at the head branches of the stream stand several of these hills, possessing bold, well defined, and beautiful forms, presenting in contrast with the timber clad hills of the mountains, interesting appearances of much singularity.

* A fact relative to the Cherry-tree meadows, derived from the authority of J. McHenry, Esq. is worthy of note; this flat possessing in most respects the peculiar marks of the other glades, is stated by him to present a plain, elevated from sixty to an hundred feet above the common level of the other glade lands.

The cause that has originated those singularly elevated plains, is, and must continue a matter of doubt and conjecture. The most common and natural opinion seems to be, that they are the beds of what once were small mountain lakes. The character and course of the streams—the frequent appearance of large trees projecting from their banks, four, six, and eight feet below the surface—the great depth of alluvial deposition—the falls which occur in Deep creek at its mouth, as well as those of the Youghagany river and Muddy creek, near the same point; may all be considered as so many proofs in favour of this hypothesis. The passage of the Youghagany river through (what seems to be a continuation of) Negro mountain, or Keyser's ridge, and afterwards through the Winding ridge; which very evidently have one day been great barriers to its waters, flooding, perhaps, all the glade country, corroborates also very strongly the same opinion, and may be regarded as striking and durable records of the great convulsions and changes which this section of country has undergone.

Of *minerals,* iron may be considered as the most prominent.—A very extensive bank of ore presents itself near the White rock run, on the bank of the Youghagany river. Several bodies of it have been found in other places, and there is every reason to believe it abounds throughout the mountain region. Some of the ores have been submitted to experiment by a skilful gentleman,* who pronounced them of good quality. Stone coal has also been found on the banks of the Youghagany, as well as in other parts; some of the banks are open for use, and the coal is found to be

* The late John Ellicot.

good. Limestone occurs in various situations; a distinct range of it may be traced on the eastern side of the Winding ridge, from the national road to the Ginseng bottom, where it abounds, and at which place the Youghagany river passes over a bed of it. Opposite this point the same range may be traced to the sources of the river.

A number of mineral springs have been discovered, but as the waters have not been analysed, their peculiar qualities are yet unknown. One of them, which rises opposite the mouth of Sang run, is represented as always having an oily coat on its surface, and is regarded by the settlers as possessing great medicinal virtues; the operation of its waters when drank even in small quantities, is said to be powerfully cathartic, and that it has been used in some cases beneficially. Another at the forks of Bear creek, is strongly impregnated with mineral substances; it is represented as having the taste of copperas, and is probably a chalybeate, of which description numbers occur. From the vast number of *licks*, places to which the deer resort on account of the saline quality of the soil, it is probable that salt water may be found in many situations.

As natural curiosities, a large cave on the Ginseng bottom,* and the several falls of Deep creek, Youghagany river, and Muddy creek, may be regarded with much interest. There is also a remarkable spring near the residence of John M'Henry, Esq. which is worthy of notice. Its waters seem to issue at a considerable depth through fissures of rock, bring-

* Salt-petre earth is found in this cave, and as long ago as 1783, temporary works were established near it, for the purpose of manufacturing powder for the hunters.

ing in its current a perfectly white and very beautiful sand, considerable quantities of which being kept in suspension by different jets, an ebullition is produced, which strongly resembles boiling. This agitation is kept up within a few inches of the surface of the water, which at the same time remains perfectly tranquil and transparent. From a low murmuring noise which is heard near the spring, it is very probable, that the stream which supplies it, passes through a rocky cavern, where, by constant attrition, the sand is produced. A very similar spring gives rise to Block run, a branch of the little Youghagany creek. There is also said to be a very curious spring on White rock run, around which the shrubbery has a reddish hue, supposed to be produced by a peculiar vapour.

As matters of further curiosity, the old forts and traces of former settlements may be mentioned. On the Ginseng-bottom, the ruins of a fortification, of circular form, distinctly appears; and on the farm of Mr. G. Friend, ten miles lower, there are to be seen the remains of three others of a similar shape. In the cultivation of the lands near them, arrow points, stone and steel tomahawks, pipes, beads, earthen ware, and numerous human bones, have been found. There are also two other forts on the banks of the Youghagany, near the Ohiopile falls, resembling, in every respect, those just described.

The *geological formation* is, in most respects, similar to the generality of mountainous countries, not, however, without some peculiarities, presenting objects worthy the attention of geologists.

EXPLANATION OF THE MAP,

And particulars relative to the Surveys.

The materials of which the accompanying map was composed, were collected from different sources. Such parts of Pennsylvania as are represented on it, were extracted from county maps, made under a special act of the legislature of that state, and may, therefore, be relied on as correct. The Virginia section was copied from the best maps extant, and the Western portion of Maryland, (all of which it embraces) is the result in part of information derived from a gentleman* who has made surveys of most of the lands in this quarter, and of individual surveys and examinations by the author. The most material features copied from this gentleman's land maps, are the Crab-tree creek and Savage river. The courses of some of the streams emptying into the Cheat river, were derived from the same source. This river, as being intimately connected with the canal project, may be regarded as an interesting feature, and it is regretted that means were not attainable to render its delineations strictly accurate; a survey and levels of it, with some of its branches had been determined on, but severe indisposition prevented the accomplishment of this design. Much care has, however, been taken to collect correct information relative to its courses and character. The profile of the National road is arranged, and the heights calculated, from a survey made of its acclivous and decli-

* Mr. William Hoye.

vous surfaces. It was made in connexion with a survey of the meanderings of the road soon after its completion, without any direct object in view, the estimates are therefore, not offered as being *strictly* correct, but are believed to be substantially so; nor were the recent surveys made with that absolute precision, that would have been requisite as preparatory to the actual execution of a canal; but may be relied upon as sufficiently accurate for preliminary purposes.

The portion of country particularly explored and delineated upon the map, is at, and contiguous to Deep creek, a tributary stream to the great Youghagany river. This creek takes its rise on the west side of the little Back-bone mountain, and is the same, which after investigations, previous to the commencement of this work, had been pronounced the most eligible, for forming a connexion with the Potomac waters.

The examinations were commenced on Deep creek near Hoop-pole ridge, the western boundary or termination of the glade, through which the stream passes by a breach or gap, from forty to fifty yards wide, denominated the *Narrows*. A considerable fall of rain the day preceding the commencement of the work, had produced a general inundation of the glade,* and obliged a delay of operations until the succeeding day. The survey and levels were then commenced about a mile above the Narrows, near the mouth of the North-

* It is stated that after the usual thaws in the spring of the year, and melting of the heavy snows which commonly fall in this quarter, that an inundation is produced, which covering the flat lands for many miles along Deep creek, produces a lake of considerable extent. This overflow frequently continues for several days, during which time, the wild fowl which frequent inland seas, in their vernal migration to the north, frequently stop, and are seen for a while sporting on the bosom of this transitory mountain lake.

glade run, (at the point F*) and pursued on that day to the Big Elk-lick, the glade still covered with water from twelve to eighteen inches deep, throughout the whole of this distance. Short stations, being requisite to obtain the meanderings of the creek, prevented any material indication of fall by the instrument—the general overflow of the waters from the Narrows to this point, and the scarcely visible current of the stream, proved sufficiently that very little existed. On the following day the levels were carried with great care from Elk-lick, up the main stream, to Hinch's branch,† along that to its source, and thence to the summit of the ridge, (at C) which was ascertained to be one hundred and seventy-one feet higher than the first named point. The distance between the source of Hinch's branch, and a spring upon the eastern side of the ridge, flowing into the Potomac, was at the time found to be one hundred perches.

For the purpose of ascertaining the lowest depression in the ridge, levels were recommenced upon Deep creek, at the junction of Hinch's branch, and carried to the source of the creek at Wetsall's spring, which proved to be eighty-two feet above Elk-lick, and twenty-one below the summit, shewing the entire elevation of the ridge (at D) above Elk-lick, to be one hundred and thirteen feet.

Numerous offsets were extended, and considerable

* See the letters of reference on the "Enlarged Section" of the summit level.

† In this distance a small branch was passed which had formerly been examined by the Virginia and Potomac commissioners, it heads in the dividing ridge at B, which point was found by them two hundred and four feet above A, the place of their commencement.

examinations made, but no greater depression, or more favourable point of connexion was discovered.*

Returning to the place at which the surveys were began, the work was pursued downwards to the Narrows, for the purpose of ascertaining the further meanderings of the stream: the general inundation, and consequent level of this portion, has already been stated. The descent was supposed in this distance not to exceed six inches, estimating it, however, at twelve inches per mile, from the Elk-lick to the Narrows, the elevation of the dividing ridge above Deep creek, at that point is found to be one hundred and sixteen feet.

At the Narrows, and for some distance above it, Deep creek has a width of from fifteen to twenty feet, with a depth of from two to four. Below, in its course to the Bridge, (of near three miles, with a fall of four feet) it receives considerable augmentation to its waters, and at that point may be estimated as passing generally, a volume of water twenty-five by three feet. In this distance an open glade of a mile in length occurs, which was also subject to the general inundation.

From the bridge to the rapids, preceding the great falls of Deep creek, a distance of five and three quarter miles, it was found to be impracticable to proceed with the levels, on account of the generally thick and impenetrable growth of the large mountain laurel; from the best observation that could be made, the fall

* Levels were carefully taken to the summit of the ridge at E, which was found to correspond in elevation with D. It has been suggested that a very great depression is found in the dividing ridge between the heads of the middle branch of Savage, and North glade run; and a gentleman who was at the trouble of making some examinations near Bromley's inn, on the National road, between a small branch of Savage, and one of Casselman's river, is of opinion that the most inferior point of elevation in the ridge is in that quarter. These points may be worthy of attention when further surveys shall be made.

was estimated at one foot per mile. The course of the stream lies through a narrow valley,* formed by the approach of tolerably distinct ridges on each side. The levels were re-commenced one mile above the principal falls, to which point sixteen feet descent was found to exist. The width of the stream is here from twenty to twenty-five yards. Deep creek having pursued its tame and sinuous course for fifteen miles, through a level bottom, appears here to have reached the great barrier hitherto obstructing the free course of its waters, which are now precipitated over a continued series of irregular falls *two hundred feet* in half a mile, to its junction with the Youghagany river: the bed of the falls is rocky, the banks abrupt and excessively rugged.†

The same rough character which marked these falls, was now found to attend the Youghagany river, from the mouth of Deep creek two and a quarter miles downwards, with a descent of one hundred and forty-two feet. From thence the channel is free from obstructions, and the waters become tranquil, and exhibit

* This valley is distinguished for a vigorous growth of timber of various kinds. Groves of white pine, of a superior description, are common; some of the trees were measured and found near two hundred feet long, and from eight to twelve feet girth.

† Any attempt to describe these wild and rugged falls must fail to give a just conception of them. The stream rushing at an angle of about five degrees, over an irregular bed of rock, may be supposed to produce an extremely turbulent series of rapids. Passing along a deep ravine, worn through rock, it presents on all sides high, craggy, and abrupt precipices. At one point on the south side appears a remarkable mass of rock, in a great measure separate and distinct from the general bank, affording an alarming spectacle: the beholder standing on the opposite side of the stream, below a perpendicular rocky bank of near an hundred feet in height, on raising his eye, the summit of this terrific pile is seen completely overhanging him: a glance at its water-worn and loosely connected base, so strongly induces the belief that the mass above him is tottering to its fall, that he is involuntarily impelled to hasten his steps onwards to avoid the apparent danger. The rude character of this pile has given it the name of the *Devil's Castle*.

a smooth surface, with banks free from rock, and generally of gentle acclivity for five miles distance. On its eastern side, a narrow but very fertile bottom of limestone land, of between two and three miles in length, occurs, and the river at one point has a channel of limestone rock. The fall in this section was found forty-seven feet. At the termination of the limestone channel, the bed of the river becomes granite, and re-assumes its precipitous course the distance of five miles, dashing its way through deep, rugged, and obstructed chasms, to the western base of the Winding ridge, and continues with but little variation two miles, to near the mouth of Bear creek. The bed and sides of the stream, throughout most of this distance, preserve a similarity of appearance; great numbers of loose mis-shapen rocks of immense size, which seem to have been brought to their present situation by the operation of some mighty torrent, continually obstruct and fret the waters in their course; the sides are craggy and precipitous, made up of irregular masses of rock, presenting, at some points, the same rude appearance, at an almost perpendicular elevation of an hundred feet.* In the distance between the commencement of the rapids and Bear creek, (seven and a half miles) the precise amount of fall could not be ascertained; it is believed to be correctly estimated at five hundred and ten feet.

From the mouth of Bear creek to Smythfield, on the National road, and thence to the mouth of Casselman's river, or *Turkey foot,* as it is generally termed, the Youghagany has a width generally of from sixty

* Marks of drift were observable throughout these rapids, generally from ten to twelve feet higher than the waters, at the time of making the survey.

to eighty yards, and would afford safe and convenient navigation at most seasons, for boats drawing from twelve to eighteen inches water. Bottom lands are found on the margin of the river throughout this distance, most of which are under cultivation.

The distance between Bear creek and Smythfield is seven miles and a half; the fall is computed at forty feet.* Between Smythfield and Turkey foot, nine miles, the fall is forty-seven feet. From the Turkey foot for a distance of five miles, the river becomes gradually restricted to a narrow channel, in which the course of the waters is frequently obstructed by rocks, thence for about the same distance, occurs a smooth and comparatively unobstructed course of the waters to the Ohiopile falls; the distance combined is ten and a half miles, the fall one hundred and nine feet. At the falls the waters descend sixteen feet, in a distance of nine chains, and are precipitated sixteen feet more by a perpendicular pitch over a bed of solid rock. The waters continue to descend from this fall, through a narrow, rocky, and much obstructed channel, for a distance of ten and a half miles, at an average rate of a little more than twenty-five feet per mile, to the mouth of Indian creek, from which point the river widens, from its late width of about thirty yards, to near an hundred, and affords a tolerable navigation at medium water, for boats of a considerable burden, to its disemboguement.

From Indian creek to Connelsville, seven and a quarter miles, the fall is eighty-three feet. From that village to the Monongahela, no levels have been taken;

* This is the only section between the dividing ridge and Connelsville, that was not subject to actual levels.

an intelligent and skilful gentleman, who made a survey of the river between those points, estimates it at two and a half feet per mile; the distance is forty miles.

RECAPITULATION

Of Distances and Descents between the Dividing Ridge and the Monongahela River.

FIRST SECTION.

	DISTANCE. miles.	qrs.	chs.	FALL. feet.
From the summit of the dividing ridge, to the Hoop-pole narrows along Deep creek, -	6	1	4	116
From the narrows to the bridge, -	2	3	0	4
From the bridge to the rapids, - -	5	3	0	6
From the rapids to the commencement of the great falls, - - - -	1	0	3	16
From the falls to the junction of the creek with the Youghagany river, -	0	2	2	200
From the mouth of the creek along the river, to the end of the first rapids, - -	2	1	0	142
From the end of the first rapids, to the commencement of the second, -	5	0	2	47
From the commencement of the second rapids, to the mouth of Bear creek,* - -	7	2	8	510
From Bear creek to Smythfield, -	7	2	18	40
Total, - -	38	3	17	1081

SECOND SECTION.

From Smythfield to Turkey foot, -	9	0	10	47
From Turkey foot to the Ohiopile falls,	10	2	4	109
From the Ohiopile falls to Indian creek,	10	2	11	268
From Indian creek to Connelsville, -	7	1	8	83
Total, - -	37	2	13	507

* Although the descents enumerated between the Bridge and the mouth of Bear creek, were not all accurately obtained along the streams, the correctness of the aggregate was proved by a careful survey of the elevations and depressions of the road between those points.

THIRD SECTION.

	DISTANCE. miles.	qrs.	chs.	FALL. feet.
From Connelsville, to the junction of the Youghagany and the Monongahela,	40	0	0	87

Aggregate.

	DISTANCE. miles.	qrs	chs.	FALL. feet.
First section,	38	3	17	1081
Second section,	37	2	18	507
Third section,	40	0	00	87
Grand Total,	116	2	10	1675

Some further surveys and observations were made subsequently to the above. The little Youghagany, a stream rising in the same ridge, and running nearly parallel with Deep creek, had been looked to as a stream, which it was supposed might be brought into requisition as a feeder to the summit-level. In order to determine this fact, levels were carried from the junction of the north and south forks of Deep creek, along the latter fork to its source, and thence across a ridge separating it from that stream: it was found at the point, (K) several feet higher than Deep creek at the forks, passing a volume of water equal to ten feet by eighteen inches, with a current of from one and a half to two miles per hour. The elevation in the dividing ridge, was ascertained to be one hundred and eighty-two feet above the junction of the forks;* the distance between the points five miles. Further examinations were also made of the ridge dividing Deep creek and the Potomac waters. The levels were taken

* A considerable depression was noticed a short distance west of this point, at (L) but it is not believed to be sufficiently low, to render practicable an open cut.

from its summit near Wetsall's spring, to a spring of Crab-tree creek, which was found to be thirty-one feet below the level of the Deep creek at the Narrows. Levels were also carried at three different points across the ridge separating the waters of Buffaloe marsh and Bear creeks, in order to ascertain the practicability of a canal route, by the way of those streams to the Youghagany river, which was regarded as possessing peculiar advantages. The general elevation of the ridge is about one hundred and thirty feet above Deep creek at the bridge. During this excursion, the survey before referred to, of the angles of elevation and depression, in the road between the bridge, and the mouth of Bear creek, was made with a view to determine their relative levels.

Practicability of the Canal Connexion.

The immense importance of a canal communication between the Atlantic and western states, has long been understood—the general utility of the measure is undisputed. It remains only to ascertain the practicability of such an undertaking, to produce a very general effort in favour of its accomplishment. The friends of the improvement are aware of, and prepared to encounter the formidable obstacle which the elevation of the mountain presents, when it is ascertained that a supply of water to effectuate the design, may be found on the summit-level. Of this interesting fact, there seems to be no question with those who have visited the ground, and it is expected the doubts of all will shortly be dissipated, by the extent and nature of the informa-

tion, which there is much reason to believe, will soon be before the public.

The particular mode of effecting the connexion at the summit by means of a dam, was first suggested by the Virginia and Maryland commissioners, in their report of a survey of the Potomac. It has subsequently been brought before the public, and additional publicity given it; but whether the plan of the dam and an open cut, or that of a tunnel will prove the most eligible means of forming the union, no decided opinion is intended to be expressed—either plan is believed to be perfectly feasible; the open cut may however, be considered the most objectionable, and would probably be the most expensive in its execution. Upon this point, it is a gratification to be enabled to present, in the following letter, the lucid views of a highly intelligent gentleman,* who, it will be seen, has minutely examined the country, and whose opinion would, under any circumstances, be entitled to the highest respect.

Mr. M'Henry's, in the Glades, Sept. 4, 1823.

Sir,

I learned with great pleasure, some time ago, that you were engaged in making surveys in this neighbourhood, with a view of ascertaining the practicability of uniting the waters of Deep creek with those of Crabtree, so as to form the summit-level of a canal from the tide water of the Potomac to the Ohio, through Savage river, the Youghiogany, and the Monongahala. The great national importance of such a communication, renders any effort toward its establishment highly interesting to all Americans; while the peculiar benefits

* Gen. R. G. Harper.

which it could not fail to confer, on the people of a larger part of Virginia, Maryland, Pennsylvania, and Ohio, give it an additional claim to the zealous support of the citizens of those states. Having long entertained these opinions, I was much gratified by hearing at Union, a few days ago, on my return from an excursion to the west, that you were in the neighbourhood; and I indulged the hope that I should meet you some where on the road, or perhaps here, and learn from you in person the progress which you had made. To my great regret, I found, on my arrival at Wiggins' on Sunday afternoon, that you had proceeded west, and that I had passed you on the road without knowing you.

Having been thus deprived of the opportunity of conferring with you personally, I take the liberty of addressing you by letter, to submit to your consideration some ideas which have occurred to me on inspecting a map of your surveys, which Mr. M'Henry was so good as to show me; and on viewing the ground in company with him. I am sure you will excuse this liberty; because it proceeds from a desire on my part, to aid in the accomplishment of the great object in which you are so laudably engaged. If my suggestions should appear to you to be worthy of attention, you will please to make such use of them as you may think proper.

I am very much pleased to find, that you consider the communication in question as not only practicable, but easy: easy I mean, in comparison with its importance. In this opinion I entirely concur, after viewing the ground, and comparing it with your survey. But there appears to me to be some difficulties in the mode of execution, which I understand you to propose. It

is the object of this letter to suggest those difficulties for your consideration, with the means by which I suppose it possible to surmount or avoid them.

It appears from your survey, that from the point F, on Deep creek, where your level commences, to the point D, on the mountain, called the Little back-bone, which divides the waters of Savage river, that is of the Potomac, from those of Deep creek or the Ohio, the elevation is one hundred and nine feet. The elevation from the Hoop-pole narrows to the point F, does not appear on the plat; but Mr. M'Henry informed me that you had ascertained it to be about five feet. This gives one hundred and fourteen feet for the whole elevation, between the Narrows and the top of the dividing ridge at D. You, as I understand, propose to overcome this elevation in part, by raising a dam of thirty-five feet in height at the Narrows; which, as your level proves, would back the water up the glade to G. Thus thirty-five feet of the whole elevation, out of one hundred and fourteen, would be gained. The residue, or seventy-nine feet, you propose to overcome by a cut through the ridge, the average depth of which you find would be twenty-five feet, through a length of one mile and a quarter. How this average depth would be distributed, that is, how far the cutting to the depth of nearly seventy-nine feet would extend, does not appear. It may be inferred however as your opinion, from your remarks on the form of the ridge, that the very deep cutting would not be of great extent.

This dam, as I understand the plan, is not only to answer the purpose of overcoming thirty-five feet of the whole elevation, by raising the water of Deep creek

to that height; but is to produce an ample reservoir, for the supply of the summit-level through the ridge, and of the descending locks at each end. And I understand it to be your opinion, that a further supply of water for this reservoir may be obtained, if necessary, by introducing the little Youghiogany through the fourth fork of Deep creek.

My great difficulty, in relation to this plan, arises from considerations connected with the dam.

When we intend raising water to a given height, by damming up a stream, it does not appear to me to be enough to ascertain what is the fall of the stream, between the place where the dam is to be erected, and that to which the water is to be raised. Two other points, and as it seems to me most essential ones, remain for inquiry. What part of the water which we find in the stream, at the site of the dam, has its source as high as the point to which we wish to raise it? And will that part be sufficient, at all seasons, to supply the necessary evaporation from the surface of the pond to be formed by the dam, and to accomplish the object for which the work is intended? I say "at all seasons;" because the supply of water for the great national canal, ought not to be exposed to interruption from the summer droughts, which would frequently render it useless when most wanted.

We must then inquire, in reference to the proposed dam, and to the supply of water expected from it, whether during the summer and fall months, those waters of Deep creek which have their sources at least thirty-five feet above its surface, at the Hoop-pole narrows, are sufficient to support the evaporation from the surface of the pond, to be produced by

the dam; and to supply not only the summit-level, but the descending locks at each of its ends.

I take it to be quite clear, upon the well known laws of fluids and gravitation, that no waters of this creek, except such as have their sources as high at least as the surface of the proposed pond or reservoir, can contribute in any manner or degree to raise it to that surface. Each tributary stream or spring will contribute in its turn, till the pond rises to the level of its source. Then it will cease to flow into the pond, and its waters will find some other vent. If its source should be in the hills, although it may first make its appearance in the valley or the marsh, it will indeed continue to contribute, as long as the pond continues to be lower than that source. What portion of the springs that first shew themselves in the lower parts of the glade, have their hidden sources in the adjacent hills, can never be ascertained. Thus much, however, may I think be affirmed as certain, that springs after flowing from their secret sources or reservoirs, in the bowels of the earth, have a constant tendency according to the laws by which fluids are governed, to find or force their way to the surface; and, consequently, that very few indeed have their sources much higher than the places where they break out.

Now, from the view which I yesterday took of Deep creek, at the bridge near Mr. M'Henry's, and at the ford in the glade, below the junction of the north and south forks, as well as of the water in those forks themselves above the junction, it appears to me that far the greater part of the water at the bridge, rises in the glade below the ford, which I take to be about midway between the junction and the point F. Much the

greater part certainly rises below the junction itself. I feel confident that the two forks together do not, at this moment, discharge a sixth part, and I believe not a tenth, of the water which flows at the bridge. Such of the smaller streams flowing into the creek, through the glade, as I saw, hardly run. The north glade run I did not see; but I understand it to be a small and feeble stream, and I know nothing of its elevation. It probably, however, rises in the glade whose name it bears; and if so, its sources can hardly lie any thing like thirty-five feet higher than Deep creek at the Narrows. Neither did I see Cherry tree Meadow creek, or Meadow Mountain creek; both of which come in below the Narrows, but above the bridge. What part of their waters lies thirty-five feet above the surface of Deep creek, at the Narrows, so as to be capable of becoming tributary to the proposed reservoir, I have no means of ascertaining. Probably, however, it is not very great. The same remarks apply equally to Buffaloe marsh creek.

From this it seems to result, that for filling the proposed reservoir and summit-level, to the height of thirty-five, or even thirty feet, reliance must be placed on the water now to be found in the two main forks of Deep creek, at points corresponding in elevation with G; and in such parts of Cherry-tree meadow creek, Meadow mountain creek, and Buffaloe marsh creek, as may be found to lie higher than the same level.

It is quite clear, I apprehend, upon the same principle, that no aid whatever can be derived from the water of the little Youghiogany, except such as lies at least as high as G. I understand from Mr. M'Henry, that you have ascertained its elevation

at K to correspond precisely with that of Deep creek at F;* and that the intervening ridge is about one hundred and seventy feet higher than those two points. You state the little Youghiogany at K, to afford abundance of water for a canal; but the true point of inquiry, with a view to the dam and reservoir under consideration, is how much water it contains at an elevation corresponding with G, or the surface of the proposed reservoir? Not having seen the stream any where above K, I have no means of forming a rational conjecture as to that quantity; but be it as great as may be required, and it probably is so, the intervening ridge seems to me to present a very formidable obstacle to its introduction. G is thirty-five feet higher than F. Consequently the part of the ridge intervening between G, and a point of corresponding elevation on the little Youghiogany, will be thirty-five feet lower than the part between K and F, which is one hundred and seventy feet. Thirty-five deducted from one hundred and seventy, leaves, therefore, one hundred and thirty-five feet, for the elevation between G, and the corresponding point on the other side, from which the water must be brought. This would certainly require a tunnel, although I have no means of estimating its length; and it would be a greater and more expensive work than the passage through the dividing ridge between the waters of Deep creek and Savage river. No doubt such a work is capable of accomplishment, and if necessary ought not to prevent the undertaking; but it would require a much larger

*The little Youghiogany at K was found to be ten feet higher than Deep creek at the confluence of the north and south branches. S.

tunnel to go from K to F; about which I shall have occasion to suggest some remarks before I conclude.

It seems therefore to me, as I stated before, that for the proposed summit-level and reservoir on the elevation of G, by means of a dam at the Narrows thirty-five feet high, reliance must be placed on the waters of Deep creek lying above that elevation: and that to ensure a supply for the summit-level and descending locks at each end, during the summer and autumn, the most essential seasons for the use of the canal, we must form the estimates upon the quantity of those waters at this time.

Let it be remembered that the present summer has enjoyed much more rain, than usually falls in the corresponding seasons: a fact about which there can be no dispute. The present state of the waters, consequently, furnishes a very favourable criterion, for ascertaining the regular supply which they may be expected to afford.*

In judging of the sufficiency of this supply, we must next advert to the regular evaporation which it must sustain; and that will depend mainly on the extent

* Mr. Harper in concluding that the quantity of water in Deep creek was greater, on account of the country having generally enjoyed more rains than common, may not have been aware, that in this section no unusual quantity had fallen. The glade streams were at all events extremely low; which circumstance may be accounted for, from the rains having fallen during the summer season, when the ground was dry and compacted: the waters were consequently shed rapidly into the streams, and carried off by floods, without at all replenishing the fountain heads, as is the consequence of rains falling in the spring, when the ground, from alternate frosts, and thaws, is open, spongy, and peculiarly adapted to absorb them. Respecting the state of the waters considerable inquiries were made, all of which resulted in a corroboration of the fact just asserted. Messrs. Wilson and Friend, intelligent and respectable settlers in this quarter, who to use their own language, "have hunted every hill, and *trap'd* on every stream in all these parts, for the last forty years," confidently assert, that Deep creek was never known to be lower. S.

of surface which the proposed pond or reservoir will present. This extent I have no means of ascertaining; but judging as well as I can from the nature and appearance of the country, between the Narrows and G, and on each side, which consists of meadows and marshes extremely flat, where the waters are hardly perceived to flow, and stretching several miles in each direction, I cannot suppose that the ground to be covered would be less than six thousand acres. Mr. M'Henry estimates it at ten thousand.* A square mile is six hundred and forty acres. Consequently 6000 acres are nine square miles, or a tract of country nine miles long, and one mile broad throughout. From such a surface the evaporation must be immense; after we have made all possible allowance for the coolness of this climate, and the frequency of summer showers. I think I may confidently pronounce from my recent and careful inspection of the chief of these streams, and the account which Mr. M'Henry has given me of the others, that they do not, altogether, at this moment, discharge water enough, if united, to turn a common breast wheel, with two run of ordinary sized stones, I feel confident that they are not together equal to Jones's falls, where it joins the tide-water near Baltimore.

How far such a stream would go towards sustaining the evaporation, under any circumstances, from a surface of nine square miles, I leave to be calculated by you, who are much more competent to the operation than I can pretend to be. I feel confident myself, on

* From a calculation made by Mr. Hoy from his land maps, it is ascertained to be about three thousand acres. S.

general considerations, that it would not be sufficient to supply this daily drain.*

It is also a consideration of no small moment, that by such a dam, six or seven thousand acres, at least, of the finest meadow land in the world would be destroyed. One of far more importance is, that it would be converted into a stagnant and pestilential pond, by which the country could not fail to be rendered very unwholesome, for many miles in every direction.

It may indeed be answered, that all these effects may be prevented, by raising an embankment on each side, to the level of the dam, and all along the creek and its branches; so as to produce a canal of convenient width, instead of this vast pond. This no doubt would be practicable; but the expense would be very great: far greater, I have no doubt, than would be required for a tunnel through the dividing ridge, on the plan which I intend to suggest for your consideration.

And, besides, if these lateral embankments were erected, so as to prevent the drain by evaporation, it would be exceedingly difficult to discharge the water, which during the winter and spring would fall or find its way into the meadows, outside of the banks; and which, if not discharged, would stagnate and putrefy in the summer and autumn, to the destruction of health in all the country around, and of a great body of most valuable land.

* No regular or precise experiments have yet been gone into in this country, relative to evaporation. In Europe, many have been made with great care by Dr. Haley, Mr. Dalton, and others, which, although they are stated to have been "conducted with *great* precision, are regarded as only of local application." Calculations founded on any data attainable, must necessarily be vague, and uncertain. Whatever the evaporation may generally be in our low lands, the quantity must certainly be much less at the elevated situation of the glade country, in consequence of its comparative low temperature. S.

And if the creek and its branches were thus embanked, so as to produce a narrow canal from the Hoop-pole narrows to G. it could receive no supply of water but that which lies higher than its level, that is, higher than G. I have already stated my reasons for thinking, that this supply taken altogether, would not be equal to that in Jones's falls, where it joins the tide; and then the question would be, whether this quantity of water would be sufficient, to supply the summit-level of the canal, and the descending locks at each end.

We must recollect that the descent at the west end to the level of Deep creek, would be thirty-five feet; that being the height of the dam, and consequently the elevation of the summit-level. This elevation would require four successive locks; how many more would be necessary, before a new supply of water would be found, I have no means of estimating. It could not be much less than four more. It is well known, that a number of locks immediately following each other, require much more water than the same number at considerable intervals. This depends on reasons which I need not explain to you. What aid could be derived from Bear creek, I have no means of knowing. Mr. M'Henry states that the dividing elevation between Bear creek and Deep creek, in the part nearest to his residence, was ascertained by you to be not less than one hundred and thirty feet, above the water of Deep creek at the bridge. If so, you must go very high up Bear creek, where it is probably, very small, before you would find it high enough to pass over this dividing ridge; and little aid can be expected from that quarter.

At the east end of the summit-level, where it would pass over the Little Back-bone mountain, the descent would be much greater, to reach the waters of Savage river, where they are sufficient to afford a new supply; and as this descent would be rapid, the locks must follow each other in close succession, to the number perhaps of ten, twelve, or more; producing a correspondent waste of water.

To supply these locks at both ends, with the evaporation and leakage from the summit-level itself, I feel a very strong persuasion that the quantity of water on which reliance must be placed, would not be sufficient. Not to speak of the operations of musk-rats, craw-fish, and other animals of that kind, which continually work holes in banks constructed of marshy earth, and in wet places, we are to recollect that this summit-level is to be supported by lateral embankments, four or five miles long, and thirty-five feet high, through a considerable part of their extent. We may readily conceive what leakage must be produced by the pressure of such a mass of water, under such circumstances; and to what certain destruction even a small opening low down in the embankment must expose it, from a pressure of twenty or thirty feet of water above.

These are the difficulties which have presented themselves to my mind, in reflecting on the proposed plan of a dam. I suggest them with hesitation, to a gentleman of your talents and practical knowledge. Perhaps you will think them imaginary, or readily perceive the means of surmounting such as may be real. They are submitted to your candour and superior knowledge, in the confidence that in whatever

light you may view my objections, you will excuse the liberty which I take in stating them, in consideration of the motive.

I will now proceed, in the same confidence, to suggest such ideas as have occurred to me, about the proper manner of executing this great project; the practicability of which I consider as most clear. In this opinion I must again express the pleasure which I derive from your concurrence and authority. Abandoning the idea of a dam at the Narrows, or any where else, it seems to me that this summit-level should be laid in the bed of Deep creek, properly widened and straightened; and that it should commence at the Hoop-pole narrows, or as much further west, as the level of the ground will permit. West of the Narrows it would of course leave the bed of the creek, and be carried on in that general direction, till the form of the ground and other circumstances might require a descent. East of the Narrows it would deepen, as the level of the ground rises, till it should approach the ridge at the proper point for passing it; and would penetrate into it, until from the depth it should be found cheaper to bore than to cut. This would depend much on the length of the tunnel, which must regulate the expense of bringing out the earth; the great expense of tunnels. Where they are very long, as two or three miles, and the thickness of the earth above is not very great, it is found cheapest to bring down shafts from the surface above, and lift the earth through them by machinery. But I feel strongly persuaded, that the tunnel in question need not be more than a half a mile in length. If so, by beginning on both sides of the ridge, the greatest dis-

tance for bringing out the earth would be reduced to a quarter of a mile;* and the expense of boring would, I apprehend, be less than that of cutting even fifty feet; for the quantity of earth to be removed would be far less in the tunnel, than in the cut. The tunnel being then carried through, the summit-level would be complete.

It would possess an ample supply of water: for it would receive all that flows in Deep creek, through the Narrows, with the addition of Buffaloe-marsh creek, Cherry-tree meadow creek, and Meadow mountain creek. This would, I believe, constitute a most ample supply, but if more should be wanted, all such parts of the waters of Bear creek, if there be such, as lie higher than the dividing ridge between that and Deep creek, might be brought in aid; and by means of a cut or tunnel the whole water of Little Youghiogany at K might be brought in at F. This would no doubt be a very great work; but if necessary to make the canal complete, the expense would be no object; and the cut or tunnel from K to F would be useful, not only as a feeder to the great canal, but as a lateral and subsiduary canal, for the country through which the Little Youghiogany flows. But I do not believe that this great and expensive work would be necessary; nor even the introduction of Bear creek, if any part of it be capable of being introduced; because I firmly believe, from a view of the waters of Deep creek at the bridge, and of Buffaloe marsh creek; that they would be amply sufficient. The descent from the summit-

* The earth, it is true, must be carted further than the mouth of the tunnel, before it can be discharged; but in a cut it must in all cases be carried an equal distance. Consequently in this respect the cut has no advantage over the tunnel.

level would be less by thirty-five feet, than on the plan of the dam. Consequently four locks less at each end would be necessary, and the new supply from the waters below would be much sooner obtained. This too would diminish the expense.* As the summit-level would lie in the bottom of Deep creek, or below it, there would be no leakage, and no loss from the perforation of the banks by aquatic animals. All the water of the adjacent glades, a great deal of which now stagnates and is taken off by evaporation, would be carried into the canal: which would much increase the supply, and convert all these fine flats into rich meadows, pastures and cornfields. The health of the country would be preserved, and many thousand acres of the finest land saved from destruction; the value of which, with the sum to be saved by the reduction of eight locks, would probably pay the whole expense of the tunnel.

This expense must depend on the length of the tunnel, and the depth of the cut on each side, before its commencement. This again will depend, not on the height of the dividing ridge, but on its width; and this circumstance must necessarily govern the location of the place where the canal ought to pass. For the purpose of ascertaining this point, some further surveys seem to be necessary; which, if you should think my ideas have any solidity, I hope that you may find leisure to make. I rode up the road with Mr. M'Henry, from Ingman's, about half a mile south-east, to the top of the dividing ridge. I found it very narrow on the top, with a rapid declivity on each side, especially on the east. A level carried from F, or

* I think it probable that the expense of these eight locks thus saved would be equal to that of a tunnel over and above a cut.

rather from the Hoop-pole narrows, which would be better, up by the mouth of Ingman's branch to the foot of the ridge, and then over it to a point on the east side, exactly on a level with the Narrows, would enable you to ascertain the length of the tunnel; which, I feel strongly persuaded, would not exceed half a mile.* Perhaps it might be still shorter from A through B, from the mouth of the fork near G through C, or from Wetsall's spring through D; all which the extension of the level over the ridge, at those several places, would enable you to ascertain with precision.

One word, before I conclude, on the expense and difficulty of tunnels; works with which we are not familiar in this country, and which, therefore, are apt to be regarded as much more formidable objects, than they are thought and known to be, where they have been made.

In the first place we must recollect, that the earth from a deep cut must be removed to a distance, as well as that from a tunnel, and to an equal distance; and that it is just as easy to dig in one case as in the other. We must also bear in mind, that if the cut be very deep, forty feet for instance, or even thirty, the quantity of earth to be dug and removed, is far greater than in a tunnel. They must both be of the same width at the bottom; that is, wide enough for the canal and a towing path. But the sides of the tunnel are perpendicular, or nearly so, and those of the cut above the canal must slant outwards, and at an angle of forty-five degrees. This makes an enormous num-

* This survey was made, and the length of tunnel requisite, was found to be one and a half miles. Formidable as the execution of such an undertaking may appear, it must, when compared with the object to be effected by it, dwindle into insignificance. S.

ber of cubic yards, where you go half a mile upon an average depth of twenty-five feet, a great part of which will be fifty, sixty, and seventy feet. A tunnel to the top of the arch need not be more than twenty feet high, the arch rising from eight or ten to twenty. If the sides should be made to slope gently inwards from the height of five feet, and terminate in a pointed gothic arch, which is probably the best mode, this arch will be higher indeed, but narrower; and the quantity of earth to be removed in this way would be nearly the same.

Suppose the tunnel to be half a mile long, and to be worked from both ends to the centre: the greatest distance to which the earth from it must be carted, will be a quarter of a mile, and the mean or average distance, will be a half quarter.* This is not a very formidable operation; and if we consider that for a cut of the mean depth of twenty-five feet, a considerable part of which would be fifty, sixty, or seventy feet, the quantity of earth to be removed would be much greater, and the distance not much if any less, we shall perceive that the difference of expense between the two operations, is by no means so great as we are apt at first to suppose.

It may be necessary to wall and arch a tunnel, or parts of it, with brick or stone; in which case the expense no doubt would be considerably increased. This must depend on the nature of the earth through which it passes, and many other circumstances which cannot be foreseen. At all events, the expense of so

* Something must be added at each end, for the cut adjoining to the tunnel, beyond which the earth must be carted. This will depend on the shape of the hill on each side.

short a tunnel as would here be necessary, can be no reason for abandoning a work of such immense national importance, and so peculiarly interesting and advantageous to four wealthy and powerful states. In England tunnels are frequent. I do not recollect their number or respective lengths; but I can easily ascertain both, as well as their ordinary expenses compared with cuts of different depths, and the mode of their construction. I am however confident, that they are often more than half a mile long, and that a tunnel of that length is never regarded in England, as sufficient to deter from the undertaking of a canal, of very far inferior importance.

Yours, &c.

On this letter it would be supererogatory to offer comment, it demonstrates the preference to which the writer's plan is entitled.—It may be proper, however, in considering the practicability of the scheme, to furnish some evidences of the adequacy of the supply of water on the summit-level, of a more definite character. A note to a speech addressed to the late canal convention, by a distinguished member thereof,* prepared from materials intended at the time to be incorporated in this work, may, in a great degree, answer the purpose. In this note it is observed, that "Deep creek," (the stream which is mainly to be relied upon,) "furnishes at the Hoop-pole narrows, six and a half miles from the summit of the dividing ridge which it is proposed to intersect, a volume of water, at the driest season of the

* Honourable C. F. Mercer.

year, at least fifteen by two feet, with an average velocity of the surface and bottom of the volume, of about one and a quarter miles per hour. It may, therefore, be assumed, as the basis of the estimate to be made of the supply of water for the summit-level of the contemplated canal, that Deep creek will, at that point, afford 16.500 cubic feet of water every five minutes; at which rate, allowing for the evaporation, absorption, and leakage, of the reservoir and descending locks, to amount to the loss of 1500 cubic feet during every five minutes of the day and night, there will remain a sufficient quantity of water to fill, every five minutes, a lock of ten feet lift, and of the length of 100 feet, and width of 15 feet; which, allowing two locks full for each boat in passing over the ridge, would afford a sufficient supply for six boats per hour, both night and day.* Should this supply, aided by the judicious application of a reservoir, be found inadequate to the intended commerce of the countries which the canal is to unite, then recurrence may be had, at an expense by no means disproportioned to the importance of the object, to a feeder from the Little Yougha-

* At this rate, if no detention was occasioned by a crowd of boats at a lock, the passage of upwards of an hundred boats might be effected daily; but considerable allowance is to be made, for the interruption and delays which must necessarily occur in passing, (as would be the case in descending either direction from the summit,) a considerable number of locks in a short distance: fixing the time necessary for the passage of a boat through a lock, at fifteen, instead of five minutes, and supposing the average load of a boat to be 20 tons, it follows, that forty-eight boats, carrying together 960 tons, may pass through any point of the canal during each day. The canal may be supposed to afford uninterrupted navigation eight months of the year, (viz. from the middle of March to the middle of November,) during which time at the above rate 230,400 may pass through it. A gentleman of intelligence who has long been familiar with the commercial intercourse between the eastern and western states, supposes that a canal which would be adequate to the transportation of 100,000 tons per year, would answer present purposes.

gany, which heads in the same dividing ridge, and runs nearly parallel to Deep creek. This feeder would require an open cut of four miles, averaging in depth about 15 feet, and not exceeding any where 35 feet in depth, of alluvial soil, with a tunnel of one and a half miles, to unite it with the waters of Deep creek in the same common reservoir. It would nearly double the supply of water derived from the latter: and, if both means combined, should yet fail of yielding a sufficient supply for the summit-level, by a feeder of smaller dimensions, but of greater length than the preceding, the numerous rivulets which swell the current of the Great Youghagany and Cheat rivers, may be drawn to the aid of the canal."

Hence it is concluded, that an entire sufficiency of water to supply the summit-level of a canal of the usual dimensions, may be commanded above the Narrows. This conclusion derives support from the opinions entertained by the late Thomas Moore, principal engineer of the Virginian board of public works, and by the Maryland and Virginia commissioners, as expressed in their different reports.* Mr. Moore states, that, "if the waters of the Youghagany should be preferred for the extension of the western section of the canal, then a branch called Deep creek will be the most eligible. There are several branches of this creek, which form a junction, and compose a stream, which may do tolerably well to supply the summit-level of a canal." This gentleman examined Deep

* The late John Ellicott, who some years since spent several days in exploring Deep creek, and the contiguous country, looking to the connexion of this stream with the Potomac; spoke with much confidence, as to the adequacy of water on the summit, and believed entirely in the practicability of a canal connexion.

creek in the month of July, when, he represents it to have been *"extremely low,"* he gives it, however, as his opinion, that "just below the forks, where several other branches unite, there is a sufficiency of water to supply a four foot canal." The commissioners whose examinations were made in the driest season, "within the memory of most men living," speak of it as being a "copious stream," and offer it as their belief, that it will "furnish sufficient water for locks, and a canal to descend and ascend *both* sides of the mountain."

It is, however, worthy of particular remark, that the beginning of the summit-level must not necessarily be confined to the Narrows. A much more judicious plan, affording equal facilities, and not incurring any additional expense in passing the dividing ridge, would be, to commence it at the head of the rapids, where the stream supplies near a treble quantity of water: a dam here of inconsiderable height, for the formation of which every facility is afforded, would flood the waters to the Narrows, and consequently leave the amount of excavation, and tunnelling the same, as if the commencement was there; while at the same time the waters so flooded, might, possibly, be made to answer all the purposes of a canal, by the mere construction of towing paths along the sides of the elongated pond, that would thus be formed. The stream receives between the Narrows and this point, the waters of five considerable creeks, besides numerous rivulets originating from vigorous springs in the ridges, which bound Deep creek valley; and is here estimated to pass at least 7000 cubic feet per minute. This quantity it is presumable is adequate to the supply of a canal with a *double* series of locks, descending both *eastward* and *west-*

ward from the extremes of the summit-level,* it is at least abundantly sufficient for a canal with one set of locks, at each extremity, under any circumstances; and cannot fail to convince the most prejudiced or skeptical, of the feasibility of the project. But a still more abundant supply may be commanded by bringing into requisition, as is believed to be practicable, the waters of the Great Youghagany river. This belief is founded on the opinion, (in which many concur,) that this stream and Deep creek, above their different falls have a correspondent level; and this opinion is justified by the following facts. The Youghagany has a very considerable fall a short distance above its confluence with Deep creek—Muddy creek, which empties into the former stream nearly opposite to the mouth of the latter, has also a great fall—the falls of Deep creek have already been noticed; the same rocky barrier seems alike to have checked the course of these streams, and to have caused their several falls—approaching from different directions, they reach it, nearly at the same point, and rushing over the impediment, mingle their waters in one common channel: hence it is supposed that the streams above the precipice have their courses over the same general level. The gentleness of their currents, and the alluvial character of the country through which they pass, seems also to give strength to this opinion. Admitting then, that the Youghagany may be drawn upon at the point in question, (it certainly can at no great distance above the falls) then all question

* To effect without delay, the transit of the commodities that would pass through the canal, it is believed a double set of locks would after some time be found requisite.

as to the adequacy of water must be at an end. The stream is here at least as large again as Deep creek, and would itself in the driest seasons, furnish more water than could possibly be demanded for the use of a single canal.

It is not to be understood as intimating that the Youghagany river, or any part of its waters, will be required on the summit at present, but it is intended to shew, that there is a source, which may at a future period, be advantageously drawn upon, to supply such an additional series of locks across the ridge, as the increasing wealth, and population, of this *immense* and *growing* empire, may gradually demand.

The suggestions contained in the following communication, will be found interesting in considering the practicability of a canal over the Alleghany mountains, since the improvement proposed, meets the most formidable, and indeed the only serious obstacle to be subdued.

Baltimore, January 15th, 1824.

SIR,

Should the following observations be found to possess an interest sufficient to warrant your annexing them to the observations you have collected, respecting a communication between the Ohio and Potomac, I would be gratified by your making this use of them.

Your obedient servant,

WM. HOWARD.

MR. JAMES SHRIVER.

On a combination of Locks, adapted to a Mountainous Country.

The Ohio and Chesapeake canal, which has been lately proposed, and of which the preparatory measures are in as rapid progress, as from the magnitude of the work could be expected, will probably far surpass any similar undertaking, both in the difficulty of the work, and in the importance of the communications it will open. The idea of raising a boat by a series of locks to the elevation of more than 2400 feet above tide, and lowering it again about 1700 feet,* appears at first sight an undertaking too extravagant for any circumstances to justify. But the immense advantages to be expected from this channel of trade, if once opened, and its importance in a political point of view, would amply compensate for any expenditure that would probably be incurred in its execution. Setting aside all consideration of expense, another question occurs on the determination of which the success of the scheme depends; whether, when executed, the work will be so embarrassed by the number of its locks, as to afford little or no advantage over land carriage. In examining this question, I believe we may assume, that even if the canal, for the short distance in which the locks are so numerous, should render the carriage on it as expensive as the transportation by land, still the advantages of the same boat being able to continue its voyage, thereby avoiding two changes of cargo, would be of immense importance.

* Lake Erie is stated to be 565 feet above tide, and the Ohio at the mouth of Big Beaver, to be 124 feet above the lake. This will give 689 feet for the elevation of the Ohio above tide at that point.

It is obvious that where a boat is required to pass 188 locks, of 8 feet lift in the distance of less than 14 miles, every precaution should be taken to avoid any delay at each lock beyond what is absolutely necessary. The older engineers were in the practice, from motives of economy or other imaginary advantages, of combining several locks together, sometimes as many as six or seven. When it is considered, that in the event of two boats meeting at such a chain of locks, the one must wait until the other has passed through the whole number, the delay of time must be obvious. Moreover, when a boat descending, finds on its arrival the locks full, (as they will be after a boat has ascended them,) it will consume as many locksful of water as the number of locks in the chain, or in other words, it will leave all the locks which it found full empty. On the other hand, a boat ascending finding all the locks empty, it will be necessary to draw 7 locksful of water from the upper summit, in a combination of 7 locks, to effect its ascent.

By the simple expedient of interposing ponds of sufficient capacity between the locks, the delay is avoided, and only one lockful of water is required to be drawn from the summit for the ascent or descent of a boat to any distance.

In consequence of these imperfections of the combined locks, which are at present well understood, they are seldom or never used, unless particular circumstances justify their adoption. An instance of this occurs in that magnificent work, the Caledonian canal, where the engineer has combined 8 locks, of 8 feet lift each, peculiar considerations, which it is unnecessary here to

detail, rendering in this case such a combination the most judicious that could be contrived.

In part of the Ohio and Chesapeake canal, the ascent from the mouth of Savage river to the summit is 1503 feet, and the distance less than 14 miles. Inclined planes have been proposed as the most useful expedient for overcoming this enormous ascent. The commissioners appointed to survey the route of the Morris canal in New Jersey, recommend that inclined planes should be used in place of common locks in that work, and appear to be very sanguine that this plan would succeed; but many objections which it would lead us too much into detail to mention here, may be urged against this proposition, more especially when intended to be applied to a canal which is expected to be a great thoroughfare. Others have suggested a double set of locks, to diminish the risk of delay to boats in their passage, and it is thought, that the increased accommodation would amply compensate for the augmented expense of their construction. But on the supposition of a double set of locks being used with ponds between them, a little consideration will shew, that each lock must be used alternately for ascending and descending, as otherwise a double consumption of both time and water will in many cases be incurred.

The plan which has suggested itself to me as the most suitable to the circumstances I have detailed, will appear at first to be a return to the errors of the old engineers. It consists in the combination of a number of locks together, and the adoption of two sets, one appropriated for ascending, and the other for descending.

By this expedient of having two sets, it appears that the following advantages will be secured.—In the first place, the circumstances which render the use of combined locks in ordinary cases, so objectionable, cannot occur on this plan. For a boat passing the chain will leave every lock, except the first of the chain, in the proper state to receive a boat following it. Thus on the descending side, the locks will be left by a boat passing them, all empty. The upper lock must therefore be filled before the boat can enter it. This being done, the water is suffered to flow from the first into the second lock; and by the time its surface is sufficiently lowered in the first lock, it has risen to the same level in the second, which is thus prepared for the boat's reception, in the same time that is necessarily consumed for the operation of the first lock. The same circumstances would be repeated throughout the whole chain. Therefore, if we suppose 5 minutes be required for a boat to pass a single lock, we may thus calculate the time necessary to pass a chain of ten locks; 5 minutes delay until the first lock be prepared, and five minutes for the passage of each lock, = 55 minutes, the time consumed in passing the whole chain.

On the ascending side, on the contrary, a boat approaching the chain will find all the locks full. The lowest lock must therefore be emptied for its reception. This will produce a delay of 5 minutes. But while the lowest lock is filling again to raise the boat, its supply of water is drawn from the next lock above, and thus this last is ready to receive the boat by the time the lowest lock is full. The same will take place in a succession of locks of any number. Of course the

time of passing a combination of locks will be the same as above—for instance of 10 locks; 5 minutes delay at the lowest lock, and 50 minutes in passing the others—total 55 minutes.

In this plan, the boats can follow each other in a continuous line. It will be necessary, however, that one lock intervene between each two boats; or in other words, the number of boats engaged in passing the chain at the same time, can only equal half the number of locks of which it consists.

It is well known to engineers, that where two locks are combined, the expense is much less than where they are separate. Of course, in this plan, the cost of a double set of combined locks, will be much less than twice that of a single set of separate locks.

The expense of lock-keepers, were the work executed on the common plan, must necessarily be very great. In the method here proposed, one or two keepers could superintend a chain of locks of any number.

In case it should be found expedient to permit the passage of boats at night, the facility with which a number of combined locks might be lighted up, would form no trifling consideration in favour of their adoption.

In thus proposing this scheme, my object is not to insist on the advantages it appears to me to possess, but merely to throw out these hints for the consideration of those, whose more extensive experience and abler judgment will enable them to form a just decision on its merits.

W. H.

Canal Route.

Passing along the meanderings of the Potomac river, from tide water to Cumberland, the canal will continue to ascend that stream to the mouth of Savage river, thence by it, and Crab-tree creek, to the dividing ridge, and through it at some convenient point between B and D. The western section will thence proceed along the valley of Deep creek to the falls: from this point to the Monongahela river, the canal must, most probably, either pass by the ravine of the Youghagany river, or above the head of the falls, (as designated on the map) by the Muddy creeks of Youghagany, and Cheat rivers, to Cheat river, and thence by that stream. Taking the Youghagany route, many formidable obstacles to the formation of a canal will be found, none of which however are of an insuperable nature. In pursuing the ravine of this river, the canal would have to cross it frequently, or be carried in many places along rocky and precipitous banks:* on more than one half of its distance, there is nevertheless highly favourable ground for canalling. Another route which would partly pass by the ravine of the Youghagany river, has been spoken of; it would leave the valley of Deep creek a little below the bridge, and proceed by the way of Buffaloe marsh and Bear creeks, to that river: this as affording an equally direct course, and as connecting with the Youghagany below the chief difficulties that occur on it, is, by persons who

* Through the politeness of the commissioners who examined the Susquehanna river, a diagram, which was engraved for their report, is permitted to be published in this work. It exhibits the mode of constructing a canal along rocky banks of rivers, and is explained by Mr. Geddes, principal engineer of the New York canal. See it at the conclusion of this article.

know the ground, esteemed a favourable route; the great elevation of the ridge separating the waters of Marsh and Bear creeks, seems a formidable, and is perhaps an insurmountable obstacle to this plan. As to the practicability of using the Muddy creeks and Cheat river as the medium of connexion, no opinion can with certainty be advanced. These streams are represented by persons familiar with them, as taking their rise in the *same pine swamp*,* as having gentle currents, and as being amply sufficient to the supply of a canal in the driest season. With regard to Cheat river, the engineer of the Virginia board of public works, states, that "that part which passes what is called the Dunkard's bottom, appears to approach as near to the Potomac, as any other point that can be considered practicable for navigation. From this place, for about five miles downwards, the fall is not too great for a sluice navigation; but then a fall occurs of nearly thirty feet, by estimation, in one mile; the lower part of which is too abrupt and broken to be improved by any other means than by a lock. From thence, to the mouth of Sandy creek, about eight or nine miles, the fall is great; particularly at one place, where it much exceeds, for the distance, the fall just described. Thence, through the Laurel hill to Henthorn's quarry, by estimation ten miles, the fall is comparatively much less.† I saw a part of this section, and had a particular

* It is a gratification to be enabled to say, that this statement has been fully corroborated by a highly respectable gentleman, who has much practical knowledge, and who speaks from an actual knowledge of the fact.

† From this point, it is believed a canal, which would shorten the distance to Pittsburg, may be carried along the flat land at the west base of Laurel hill, to Redstone creek, near Union town, and thence, by the ravine of that stream to the Monongahela, below Brownsville. This, as a subsidiary canal alone, is worthy of attention.

description of the remainder, from which I suppose it does not exceed ten feet per mile, and not too abrupt in any one place to be overcome by sluices. Thence, to the junction of the Monongahela, about twelve miles, it has been declared navigable by the laws of Virginia."

From these particulars it results, that if the elevation at the sources of the Muddy creeks is easily surmountable, this route will be quite feasible.—In point of distance, to the navigable waters of the Monongahela, and in many other respects it has decided advantages.

The attention of the public has also been directed to a route, which was to connect the eastern and western waters by Will's creek, and a branch of Casselman's river; this appears to have been in a great measure visionary.

DISTANCES

Of different sections of the Chesapeake and Ohio Canal.

EASTERN SECTION.

	Miles.	Chains.
From the summit-level to the mouth of Savage river,	13	00
Thence to the mouth of Will's creek,	33	37
Thence to the mouth of Capon,	54	40
Thence to the Conococheague,	33	40
Thence to Harper's ferry,	38	60
Thence to head of the Great falls,	46	20
Thence to the head of tide water,	9	00
Total,	228	37

WESTERN SECTION.—*Youghagany Route.*

	Miles.	Chains
From the dividing ridge to the Narrows,	6	24
Thence to the falls of Deep creek,	8	40
Thence to Smythfield,	24	13
Thence to Connelsville,	37	53
Thence to Monongahela,	40	00
Total,	116	50

WESTERN SECTION.—*Cheat river Route.*

From the dividing ridge to the falls,	14	64
Thence to Cheat river,	15	00
Thence along Cheat river to west side Laurel hill,	12	00
Thence to the Monongahela,	12	00
Total,	53	64

SUMMARY OF DISTANCES.

Distances between the tide water of the Potomac and the Monongahela rivers—Youghagany route.

Eastern section,	228	37
Western section,	116	50
Total,	345	07

Distances between the tide water of the Potomac and the Monongahela river—Cheat river route.

Eastern section,	228	37
Western section,	53	64
Total,	282	21

Difference in favour of the Cheat river route to the Monongahela,	62	66

Total distance from the tide of Potomac to Pittsburg, via the Youghagany and Monongahela.

From tide of Potomac to the Monongahela,	345	07
From thence to Pittsburg,	15	00
Total,	360	7

Total distance from the tide of Potomac to Pittsburg, via Cheat river and Monongahela.

	Miles.	Chains.
From tide of Potomac to the Monongahela, -	282	21
From thence to Pittsburg, - - - - -	100	00
Total, -	382	21
Difference in favour of the Youghagany route to Pittsburg, - - - - - - -	22	59

Note.—Some of the above distances are from computation, the most of them are, however, from actual admeasurement.

Extract from Mr. Geddes' Report on an Examination of the Susquehanna River.

"From a view of the annexed diagram, it will appear that on the face of a slope rising forty-five feet degrees from the horizon, there will be required, the removal of seventy-two cubic yards, per yard run, of rocks or earth; (if any earth shall be found so near the surface,) to form a space for the reception of the lining, &c. of the canal, and that the rude wall to support the work, will be on the outside forty-five feet high. But, in few instances, will it be required to carry the canal forty-five feet higher than the level of the surface of the river adjoining it.

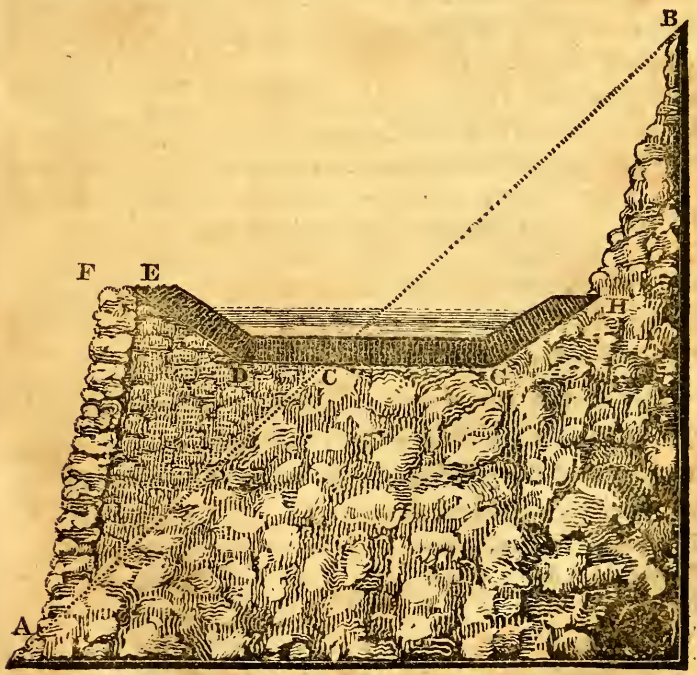
"A canal would be constructed, in such a place, by forming an excavation or trough to contain the water: first, of these great loose stones, supported by a rude *dry wall* on the lower side. Over the bottom, and up both sides, then faced with pounded stones, made finer than on a good turnpike road. Next, coated with the best gravel, coarse at first, but very fine on the surface. It is now prepared for the last lining of earth, which

would vary in the thickness, as it might happen to be porous or water-tight stuff; water to give this earth a partial puddling, would in most places be collected from little streams out of the hills, and, in some places, would have to be pumped from the river below."

EXPLANATION.

A, B, shows the face of a hill rising in an angle of forty-five degrees from the horizon.

A, C, D, E, F, is the section formed of what is taken from the space C, G, H, B, each equal to seventy-two yards superficial measure, making seventy-two cubic yards for each yard measured along the canal.



Angle 45 degrees, scale 24 feet to an inch.

Estimates of Expense.

It was ardently wished to have collected full and particular information of every branch, pertaining to the subject of the proposed canal, but to have obtained it as accurately as would be demanded preparatory to the actual execution of such a work, it will at once occur, was far beyond accomplishment by individual means. The deficiency is felt and regretted; in the absence of data for more precise calculations, the following general estimate of cost has been attempted.

From an analysis of Mr. Briggs's estimates, it appears that the different sections of the proposed canal between Cumberland and tide-water, upon the Potomac, will cost (omitting fractions) an average per mile, for excavation, walling, acqueducts, dams, culverts, and bridges, as follows:

		Miles.	Dollars.
1st section.	From Cumberland to Capon,	54½	5,268
2d do.	From Capon to Conococheague,	33½	5,924
3d do.	From Conococheague to Harper's Ferry,	38¾	6,356
4th do.	From Harper's Ferry to the Great Falls,	46¼	5,608
5th do.	From Great Falls to tide-water,	9	11,936
	Total,	182	

Average rate, on the whole distance, 6,037 dollars.

The cost of the same sections, after adding for lockage, (estimated at 650 dollars per foot) and including ten per cent for contingencies, &c. will be according to Mr. Briggs's general summary.

	Dollars.	
For the 1st section,	7,711	per mile.
For the 2d do.	8,055	
For the 3d do.	8,483	
For the 4th do.	7,499	
For the 5th do.	23,702	
Total cost,	1,578,954	

Average rate, $8,676 per mile.

The sections of the canal here estimated, are believed to be quite as difficult of execution as the generality of the portions west of the dividing ridge; the most difficult, and undoubtedly the most expensive section, is from Cumberland, or the mouth of Will's creek, to the dividing ridge, as well as can at present be ascertained, forty-six miles long, with about 1900 feet of lockage, to the base of the proposed summit level; applying $8,000 (near Mr. Briggs's average estimate) to this section throughout, it will cost for excavation, &c. forty-six miles, at $8,000 per mile, $368,000; and for lockage, 1900 feet, at $650 per foot, $1,235,000, making together a sum of $1,603,000.

The calculations for the next six and an half miles, forming the summit-level, are predicated upon a subterranean canal, of one and an half, and an open canal of five miles in length. The expense of tunnelling depends so materially upon a variety of circumstances, impossible to be ascertained, that it admits of no accurate or certain estimates. In England, it has been found to vary considerably,* generally according to the nature of the ground through which the tunnels were carried; the average cost is set down at about $125,000

* "The canal of the Trent and Mersey, connecting the ports of Liverpool and Hull, in England, with seventy-six locks, has no less than five tunnels in 93 miles. Of these, the one at Harecastle, is 2,888 yards long, and more than 70 yards below the surface of the earth. The celebrated Brindley estimated its cost at 10,000 pounds. It was the first tunnel constructed in England, and actually cost 3l. 10s. 8d. per yard.

"That at Sapperton, part of a canal, 42 feet in breadth, which unites the Thames and the Severn, is more than two and a half miles in length, and is cut, for four-fifths of that extent, through solid rock, at the expense of eight guineas a yard.

"The Chesterfield canal has, at Hartshill, a tunnel 3,000 yards long. But tunnels are, now, very numerous in England; and in cost for labour only, vary from three to seven guineas per running yard."

Extract from Mr. C. F. Mercer's Speech to the Canal Convention.

per mile.* Mr. Briggs has recently estimated the cost of a tunnel, two and an half miles long, at $150,000 per mile; the proposed tunnel being but one and an half miles long, and there being no reason to apprehend that the ground to be operated upon will oppose any unusual impediments, the average cost in England, it is believed, may be safely assumed as amply sufficient for making the projected tunnel; it gives accordingly for its cost, $187,500. Three of the five miles of open cut on the summit, will require an average cutting of about fifteen feet in depth, on the remaining two, a comparatively small cutting will be necessary; the quantity of earth to be removed to form the canal, is estimated at 500,000 cubic yards, which, at twenty-five cents per yard, amounts to $125,000, giving $312,500 for the combined cost of the tunnel and open canal forming the summit-level. Westwardly, from the extremity of the summit-level to the commencement of Deep creek falls, eight and an half miles, it is believed a canal may be made for less than $5,000 per mile, estimating it, however, at that sum; $42,500 is the result for canalling, which, added to $6,500 for ten feet lockage, makes for the section $49,000.

The section which succeeds from the commencement of Deep creek falls to the mouth of Bear creek, pre-

* "On the subject of the expense attending tunnels, as compared with that of open canals of different depths, I found that we possessed here all that has been ascertained in England. I therefore forbore to write to that country, and will give you the result produced in relation to our great object, by the application of the English estimates, to the ground on which we are to operate. These estimates have been formed, as I understand, on the combined average of their various tunnels and canals.

"It has been found in England, that the average cost of tunnels is about $125,000 to the mile,—this will give $187,500 for the cost of the tunnel in question."

Extract of a letter from Gen. R. G. Harper.

sents more difficulties, and the construction of a canal, will in all respects be attended with more expense, than any portion of the same extent west of the mountains; the distance is sixteen and a quarter miles, the fall 915 feet. The excavation, &c. is estimated at the same sum per mile, that was applied to the section between Cumberland and the dividing ridge; this will give for canalling, $130,000; 915 feet lockage, at $650 per foot, is $594,750, making together $724,750. From the mouth of Bear creek to the Ohiopile falls, a canal is considered easy of execution, compared with the latter, or succeeding section: $6000 per mile, is estimated as ample for the execution of the canal. The distance is twenty-seven and a half miles, the fall 196 feet. The cost respectively, for excavation and lockage, will consequently be $165,000, and $127,400, together, $292,400. The next section, ending at the mouth of Indian creek, is ten and three quarter miles long, with a fall of 268 feet, estimating the excavation, &c. at $7,000 per mile, gives for canalling, $75,250; for lockage, $174,200—making the whole cost, $249,450. From thence to the Monongahela river, a fraction over forty seven and a quarter miles, the cost will not exceed $6,000 per mile, which gives for canalling, $283,500. The amount of lockage being 170 feet, will cost $110,500—making the total cost for this last section, $394,000.

Recapitulation of Estimates.

EASTERN SECTION.

	Dollars.	Total Dollars.
For 46 miles of canal, - - -	368,000	1,603,000
For 1900 feet lockage, -	1,235,000	
Add 10 per cent for contingencies, - -		160,300
Total, - -		1,763,300

SUMMIT-LEVEL.

For 1½ miles tunnel, - - -	187,500	312,500
For excavating 500,000 cubic yds earth,	125,000	
Add 10 per cent for contingencies, &c. -		31,250
Total, - -		343,750

FIRST WESTERN SECTION.

For 8½ miles canal, - - -	42,500	49,000
For 10 feet lockage, - - -	6,500	

SECOND WESTERN SECTION.

For 16¼ miles canal, - - -	130,000	724,750
For 915 feet lockage, - -	594,750	

THIRD WESTERN SECTION.

For 27½ miles canal, - - -	165,000	292,400
For 196 feet lockage, - -	127,400	

FOURTH WESTERN SECTION.

For 10¾ miles canal, - - -	75,250	249,450
For 268 feet lockage, - -	174,200	

FIFTH WESTERN SECTION.

For 47¼ miles canal, - - -	283,500	394,000
For 170 feet lockage, - -	110,500	
		1,709,600
Add 10 per cent for contingencies, &c. -		170,960
Total, -		1,880,560

Summary of Estimates.

First eastern section according to Mr. Briggs's estimates,	$1,578,954
Second eastern section,	1,763,300
Summit-level,	343,750
Total western sections,	1,880,560
Grand total,	5,566,564

In pursuing the Cheat river route, should it be found equally practicable, the sum which would be required to make a canal from the tide of the Potomac to the navigable waters of the Monongahela, would be much less than the sum estimated above. It cannot, however, be pretended to say, what the difference would amount to.

The Advantages of Canal over Land Transportation.

Although this subject is not strictly comprehended within the design of this work, it is nevertheless believed, that some notice of it will not be altogether unacceptable. The Maryland and Virginia commissioners, appointed to survey the Potomac, estimated the comparative advantages minutely, as appears by the following statement extracted from their report.

The amount of toll on a ton of merchandise, being stated at one cent per mile, and the freight also at one cent per mile, and eight men, and eight wagons, and forty horses being the number required to transport the burthen of one boat, drawn by one horse and managed by a man and a boy, viz. 25 tons. Assume, then, equal rates of expense, as the basis of calculation: Say, for

example, they each proceed one hundred miles; the wagons by land, and the boat by canal, and each travel twenty miles a day, carrying 25 tons of goods; the expenses of one wagon per day, say, is, for one man one dollar, for five horses five dollars, that is $6 00

The expenses, then, of eight wagons, eight men, and forty horses, is, per day, - - - - - - 48 00

The boat, at the same rates, is, for one man, one dollar, one boy fifty cents, and a horse one dollar, each day, - - - - - - - - - 2 50

It requires five days, at the rate of travelling assumed, to perform the trip of one hundred miles; five times the daily expenses of wagons is, - - - 240 00

Five times the daily expenses of the boat is, - 12 50

The difference in the cost of freight of 25 tons by land, or water, free from toll, is, - - - - $227 50

Next add the interest on the out-fit for land carriage, and the same for the boat, &c. A wagon cost, when new, say $100, then eight wagons cost $800, and forty horses, each $100, amount together to 4,800 00

The gear of five horses, when new, say, cost $50, and of forty horses, therefore is, - - - 400 00

$5,200 00

A boat, seventy feet long, ten feet wide, say, will cost $150, and the horse and gear $110, that is for canal out-fit, - - - - - - 260 00

Difference, - - $4,940 00

The annual interest on $4,940, at six per cent is, $296 40

A wagon, it is supposed, cannot last in service on the road more than eight years without repairs, then the rate of the wear of a wagon, may be stated per annum, at one eighth of the cost.

For repairs of each wagon per annum, - -	$12 50
Horses in constant use, in heavy draft, it is supposed, cannot be fit for service more than five years on an average, then one-fifth of the cost is the allowance for loss of horses; this for five horses, is equal to - - - - - - - - - -	100 00
A horse in service will require a new set of shoes every two months; this, for five horses, makes the wear of shoes, - - - - - - - -	30 00
The gear of five horses is worth, new, $50, and will last on an average, say, five years; then we may add for this item of wear per annum, for each,	10 00
At these rates calculate the difference.	
The interest on the out-fit of eight wagons, and forty horses, after deducting the cost of boat and horse,	296 40
Wear of eight wagons, each $12.50, is - -	100 00
Wear of forty horses as above, - - - - -	800 00
Shoes for forty horses as above, - - - - -	240 00
Wear of gear as above, - - - - - -	80 00
	$1,516 40

The cost of the boat and horse having been deducted from the sum on which interest is taken, no interest is therefore charged here; a boat will surely last longer than a wagon in service, but we will state it at the same, that is eight years, then take one-eighth of 150, the first cost for the wear of a boat per annum, - - - - - - - -	$18 75
Wear of one horse, - - - - - -	20 00
Shoes for one horse, as above, - - - - -	6 00
Wear of gear, as above, - - - - - -	2 00
	$46 75
Difference in wear and interest in one year,	$1,469 65

To understand this difference more exactly, let the expenses per day, for five days, as above, on each kind of transportation, be added to a proportion of the sum of the annual wear and interest, equal to five days.

Expenses of eight wagons, &c. per day, - -	$240 00
$1,516 and 40 cents, divided by 73, gives the wear, interest, &c. for five days, viz. - - -	20 77
Entire expenses of wagons, per day, - -	$260 77
Same expenses, for same time, of the boat, &c. is,	$12 50
$46 and 75 cents divided by 73, is, - -	64
Entire expense of boat, &c. per day, - -	$13 14

The sums total of the expense of each mode, divided by each other, viz. $260.77 by $13.14, shews that the expenses of land carriage may be stated, in round numbers, at twenty times the cost of transportation by water; besides changing the employments of the supernumerary carriers, in extensive districts of country, from the unproductive to the productive classes of citizens.

The disadvantage of land transportation in this statement, so strikingly displayed, is experienced, and every where acknowledged. A report on internal improvements, made by Mr. Knight, in the legislature of Pennsylvania, states, "that the amount to be paid to wagoners for transporting goods to Pittsburg, Wheeling, and some of the smaller towns in the western part of Pennsylvania and Virginia, will, in a very few years, average at least one million and a half of dollars per annum, unless, indeed, some cheaper mode be in the meantime devised." The correctness of this estimate is corroborated by statements made upon the floor of Congress;* and perhaps confirmed by a letter from an

* The following statement appears in a speech of Mr. Stewart's, in Congress. It is due to this gentleman, and not improper to be stated in this place, that he was the first to introduce the interesting subject of the proposed canal to the consideration of Congress.

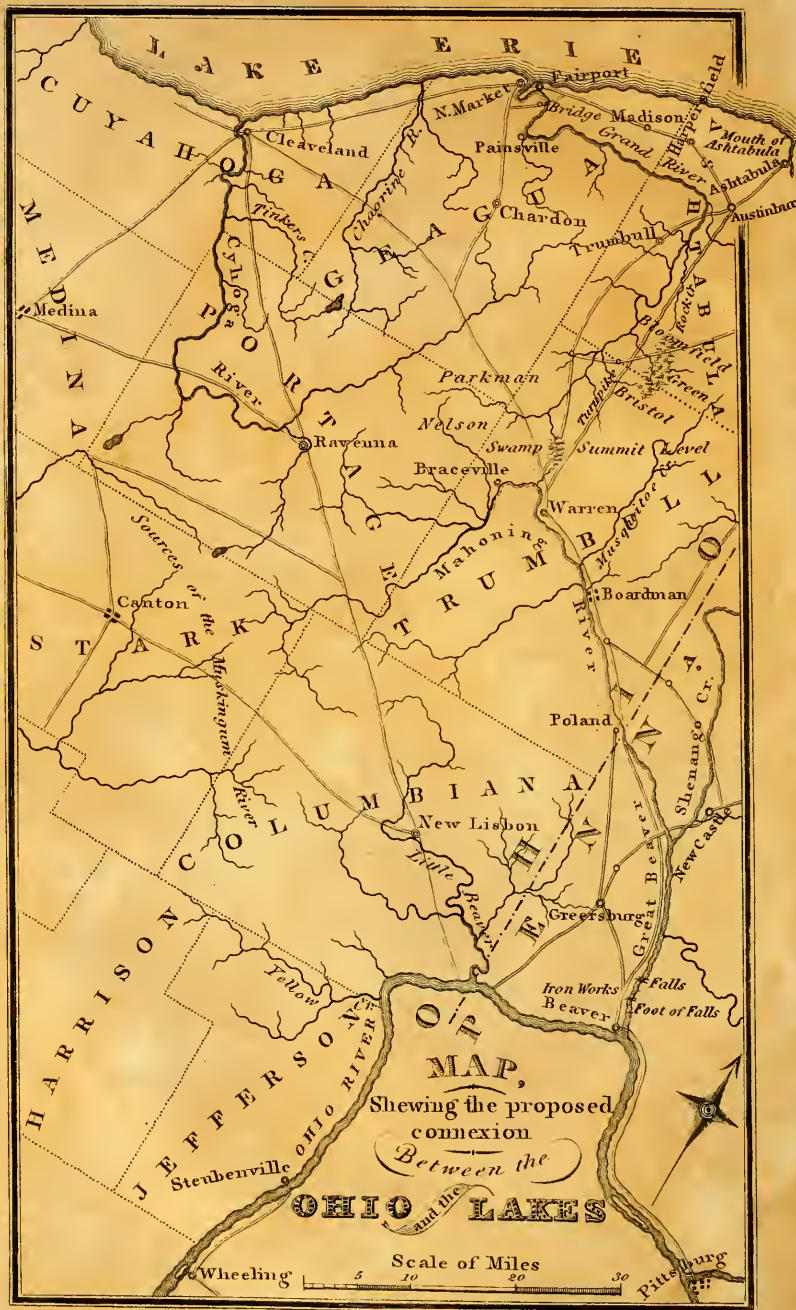
intelligent and respectable mercantile house in Wheeling, which states that during the year 1822, they had consigned to them 1081 wagons laden with merchandise, averaging about 3500 pounds each, the carriage of which amounted to $90,000. Three-fourths of the wagons, it was supposed, obtained return loading from Wheeling. There are, besides the house from whom the information is derived, five other commission stores in Wheeling; estimating that each of these received two thirds the quantity of goods consigned to the first, it shews that 4684 loads of merchandise were received

"It has been ascertained," said Mr. S. "that the sum paid in Pittsburg alone, in one year, for the transportation of goods for the supply of Ohio, Kentucky, &c had amounted to $1,500,000. The difference in the cost of transportation by canals and by land, has been ascertained to be as twenty to one. This was, he believed, a common result to which all writers on the subject had come, and which was confirmed by the use of canals wherever adopted; divide the sum then by 20, and it will be reduced by the canal, to $75,000, saving the west from an annual taxation of $1,425,000. For the cost of transportation was he said, paid by the *consumer* of the goods, in the same way that he paid the *duty* that enriched the public treasury. But Pittsburg was not the only place of deposit. Mr. S. here read from a letter which he had lately received from a respectable merchant in Wheeling, who stated, that he received on an average, three millions of dollars worth of goods per annum, at his store, transported on the Cumberland road, for the carriage of which, he paid about $120,000; by the canal, this sum would be reduced (according to the principle of the report to which he referred) to $6,000. But an equal saving would be effected on the transportation of the agricultural, and other products of the interior, to the eastern markets. He would mention, he said, a single fact, which might illustrate the importance of this object; from the returns of the Marshals in 1810, it appeared that there had been manufactured in the western counties of Pennsylvania alone, in that year, 417,181 barrels of flour and whiskey. These articles were now carried principally over the mountains in wagons, at an expense of about $3 per barrel, which, by the canal, would be reduced to 15 cents per barrel. The glass manufactured in his neighbourhood, he said, was transported to Baltimore by land, at the expense of near one fourth of the price received; (a higher duty than was paid by the foreign article;) on this canal, instead of one dollar per box, they would pay 5 cents. These were a few instances selected to illustrate the advantage of this work; and the results, he repeated, were inevitable, if the principle laid down in the report, was correct; and it was confirmed by universal experience, and by all writers on the subject, with which he had become acquainted."—[*Extract from Mr. Stewart's Speech on the proposed connexion of the Eastern and Western waters.*

at that town during the year mentioned. This number, at the rate of $90,000 for 1081 loads, gives for the cost of transporting merchandise from Baltimore to Wheeling, the sum of *three hundred and ninety thousand dollars, during one year:* add to this sum, for return loading, only one half, instead of three-fourths, the amount estimated, and the amount paid for transportation is shewn to be *five hundred and eighty five thousand dollars.*

Let it be remembered, that these were the transportations of 1822, during which, the sales of merchandise for the western states is known to have been smaller, than within any of the three preceding years, or for the subsequent or past year. In the year 1821, the amount paid for transportation upon consignments to a single house in Wheeling, was about $120,000; assuming nevertheless the expense of 1822, as the average, it appears that *two millions, nine hundred and twenty-five thousand dollars* have been paid for transportation within *five years.*

The cost of land transportation, being *twenty* times greater than canal transportation, it follows that a canal would have effected a saving of *two millions, seven hundred and seventy-eight thousand, seven hundred and fifty dollars* of the sum actually paid for transporting merchandise between Baltimore and Wheeling within the last five years.


LAKE ERIE
Fairport
N. Market
Bridge
Madison
Painsville
Grand River
Mouth of Ashtabula Cr.
Ashtabula
Austinburg
Cleaveland
CUYAHOGA
Tinkers Cr.
Chagrin R.
Chardon
Trumbull
GEAUGA
Rocky R.
Bloomfield
Greene
Medina
MEDINA
Cuyahoga River
PORTAGE
Parkman
Turnpike
Bristol
Nelson
Ravenna
Swamp
Summit Level
Braceville
Warren
Mahoning
Mosquito Cr.
TRUMBULL
Sources of the Muskingum
Canton
STARK
Boardman
Mahoning River
Poland
Shenango Cr.
COLUMBIANA
New Lisbon
Little Beaver
Great Beaver
New Castle
Greersburg
HARRISON
Yellow Cr.
Iron Works
Falls
Foot of Falls
Beaver
OHIO
MAP,
Shewing the proposed
connexion
Between the
OHIO
and the
LAKES
JEFFERSON
OHIO RIVER
Steubenville
Wheeling
Scale of Miles
5 10 20 30
Pittsburg

OHIO AND LAKE ERIE CANAL.

The proposed *Ohio and Lake Erie Canal*, is intimately blended with that of the *Chesapeake and Ohio*. In the opinion of many, it is embraced and constitutes only a part of the same grand design: but whether it be considered in connexion with it, or independently, it is confessedly a project of vast public importance, involving considerations of great national and local concern. Although it was not comprehended in the original design of this publication, these considerations have induced the author to undertake the labour of collecting all the information which was attainable upon the subject. The result is sincerely gratifying, since it establishes not only the entire practicability of executing such a work, but it proves also, that the nature of the country affords a choice of routes, without any material obstacle.

To the politeness of several distinguished and public spirited gentlemen, the author is chiefly indebted for the materials which have enabled him to compile the accompanying map of that part of the state of Ohio, through which the canal is proposed to be conducted. The same gentlemen, by the following letters and document, have afforded the means of presenting a perspicuous account of all the surveys and examinations hitherto made, comprising a mass of valuable and highly interesting information, which proves incontestibly the feasibility, at a moderate expense, of a connecting canal between the Ohio and the lakes.

Letter from Mr. A. Stewart, Member of Congress.

CONGRESS HALL, Dec. 25th, 1823.

SIR,

Mr. Whittlesey handed me the map you sent for examination with the enclosed letters, one written by himself, and the other by Judge Tappan, of Ohio, a gentleman of much intelligence; I send you also a report of Mr. Geddes, handed me by Governor Brown, of the same state, who has appended to it some notes. I am much gratified to discover that the facts they communicate, connected with the surveys you have made, completely demonstrates the perfect practicability of the whole canal route, indicated by the President in his late message, extending from the seat of the national government through Pittsburg, to lake Erie. As to the policy of this grand national design, there can be but one opinion among the liberal and enlightened politicians of our country. Its practicability, however, has been doubted. This difficulty removed, and this great object will be speedily accomplished. I have heard several distinguished gentlemen in Congress, both from the north and south, speak of it in terms of the highest approbation—they express a willingness to appropriate the whole sum required, without resorting to states or individuals for aid; being a national object, it ought, they said, to be accomplished by national means. They regard it as connecting the seat of the national government with the western states, and as constituting a powerful bond of union between them; affording, in time of peace, the greatest facilities to commercial intercourse, and in time of war, one of the most efficient means of national defence.

General Jessup requested me to inform you, that owing to a press of business at this moment, he is fearful it will not be in his power to communicate the information you desire in time to answer your purpose. He spoke, however, of the object in terms of the highest approbation, and stated, that the government had already experienced great advantage from the use of the New-York canal, whither he had sent for minute information on the subject. It might be safely assured, he said, that it would produce a saving to the government of at least two-thirds of the whole expense of transportation, besides it would add greatly to the celerity of our military movements, which was often of the utmost importance, and would deliver the troops at the point where their services were required, unbroken by the fatigue of long and forced marches;—his views on the subject in every point of view, are liberal and enlightened, and I hope he will have time to communicate them before your work goes to press; it would place the subject in a new and important light before the public. However, no one who is at all conversant with the history of our late war, with the disasters, losses, and delays, experienced on the northern frontier, where it cost the government, in some instances, $100 for a single barrel of flour, can doubt the importance of a canal connecting the whole of our lake frontier with the seat of the national government, passing through the very heart of the country, and opening new and abundant sources of wealth, which must forever remain dormant without it.

Yours respectfully,

A. STEWART.

Letter from E. Whittlesey, Esq.

WASHINGTON CITY, Dec. 25th, 1823.

SIR,

I herewith return the map handed to me by Mr. Stewart, with some corrections noted. I have waited, in hopes of receiving answers from Judge Tappan and Mr. Brown, accompanied with accurate maps of that section of the country, and the result of their examination, but none have arrived.*

The canal will pass up the Mahoning valley, about four miles north of Warren, where is the summit-level between the lake and the Ohio, in a swamp that discharges its waters into both, elevated above the lake about 342 feet, and above the Ohio about 218 feet. To supply a canal with water at this point, the head waters of Grand river particularly,—a stream, durable, but small, that runs through Parkman, a branch of Mahaning, that runs through Nelson, and the Cuyahoga, must be resorted to. An examination has been made, and no doubt exists, but that the Cuyahoga may be brought to this summit-leve with little expense. The Grand river will be descended to Austinburgh, to the point where the stream takes a western course, and thus far the water is for the most part deep and still. It is a subject of some doubt, whether a canal can be cut from thence directly to the lake, and terminate at the mouth of the Ashtabula, or descend in the valley of Grand river. On this direct route, towards the north line of Austinburgh, is a swell of land that may present an insurmountable barrier; and in descending Grand river, the banks of which are high, and com-

* They were received a few days subsequent to the receipt of this letter.

posed of slate, frequently shift sides of the river. Before a canal is located in that section of the country, an examination will probably be made between the summit-level above Warren, and the Cuyahoga at Franklin, six miles west of Ravenna, to ascertain whether a canal may not be cut in that direction, and terminate at Cleaveland. It is generally believed that the lowest summit-level is at the head waters of the Pymatuning, a branch of the Shenango creek and the Ashtabula; an examination of this route has not been made within my knowledge, and it may be a subject of uncertainty whether a sufficient supply of water can be carried to this summit-level; yet the inhabitants in that quarter are of the opinion that a supply of water may be obtained. The country on this route, as on the others, is generally level, and well adapted to an undertaking of the kind. We have the fullest confidence that some one, or all of these routes, will be found practicable, and as a continuation of the Potomac and Ohio canal, more important than any other route farther west. A canal through the eastern section of the state of Ohio may be constructed for less than the expense of any other route, and will open a direct communication between the lakes and the Ohio. The many advantages that will be derived from this communication, are stated in a publication signed "Ohio Farmer,"* and need not again be repeated.

Yours respectfully,

E. WHITTLESEY.

* This communication is from the pen of the Hon. B. Ruggles, of Ohio. As an article containing some interesting particulars relative to the contemplated canal schemes, it is embraced in this work with much satisfaction. S.

Extract of a Letter from Judge Tappan, of Ohio.

STUBENVILLE, 18th Dec. 1823.

The summit between Grand river and the Mahoning, is three hundred and forty-two feet above lake Erie.

		Feet.	In.	Ths.
From the summit to the Mahoning at Warren,	-	53	3	5
Thence to Youngstown,	- - - -	34	7	5
Mahoning at Lovelands,	- - - - -	7	4	0
Dr. Adams' surface Beaver, head of the falls,	-	62	8	5
Brighton forge dam,	- - 398.1 perches,	10	9	0
David Townsend's dam	- 168.45 do	10	2	0
Lower falls dam,	- - 87. do	7	9	0
Low water mark at the foot of falls,	192. do	15	1	5
Ohio river,	- - - - 466.35 do	12	8	5
Total fall to the Ohio at low water,	-	214	5	5

The whole route which is proposed for a canal here, may be said to present uncommon facilities for such a work: from the summit towards the lake, the country is level with a small declination towards the lake, until you arrive within ten miles of it; it is then more uneven, and there may be some difficulty in passing the ridge. This indeed may be such as to divert the canal to the east, down the valley of Ashtabula, or to the west down that of Grand river, both of which routes are practicable, although by taking either, the expense would be enhanced; for, as these streams run here in deep vallies with narrow bottoms, the rapid currents sweep from side to side of the bottom lands, washing alternately upon the right and left high cliffs of sand, stone, and argillite, a canal down either valley must be secured from flood, by much outer wall, and will beside have to cross the stream many times. A route through the ridge will present only a deep cut-

ting, and possibly on a careful examination, even this anticipated obstacle may be avoided. From the summit-level to the Ohio, the canal *must* go down the valley of Mahoning and Big Beaver, and it may do this without any serious difficulty, by crossing the Mahoning near Warren, until you arrive at Brighton; from this place to the Ohio, the best route will be to cross the river and go down upon the left side, which will require an aqueduct bridge of five or six hundred feet. I say the best route with some diffidence, because it is practicable to continue down the right side of the river, and the expense of both routes should be carefully estimated before either is adopted *as the best.* The difficulties which present themselves down the valley of Mahoning and Big Beaver, are principally the upland points washed by the stream, which in one or two places may crowd the canal into the bed of the river; whenever this may happen, materials for an outside wall are found convenient. The principal expense will be the locks, for which sand stone of a good quality, is found on or near the whole route, and water-lime may be procured on the Ohio, from the mouth of Little Beaver to Wheeling, where it is abundant.

Extract of a Letter from Mr. E. Brown, of Ohio.

Bloomfield, Dec. 19, 1823.

Agreeably to your request, I will endeavour to give you all the information I possess, in relation to the eastern route, recently surveyed under the direction of the canal commissioners. The place assumed as the summit-level on this route, as you already know, is a small swamp in Champion, situate about mid-way between the boatable waters of the Mahoning and

Grand rivers. I say *boatable waters*, because both of these rivers, at certain seasons of the year, have been navigated, ascending and descending, by boats of considerable burthen, all the way between their mouths, and to within five or six miles of this summit-level, without any obstruction, other than mill-dams on both, and the falls of Beaver on one.

This swamp or summit-level, it will doubtless occur to your recollection, was ascertained to be, by Mr. Geddes's survey, 342 feet above the levels of lake Erie, and by a continued survey by Judge Tappan to the Ohio river, about 240 feet higher than that river at the mouth of Beaver. You will also recollect that by the first mentioned survey, it was found that, without much expense, a branch of the Mahoning that runs through Nelson, a considerable stream, a branch of Grand river that runs through Parkman, a very permanent stream, and the Cuyahoga river itself, could all be improved as feeders, at the above mentioned summit-level.

As not much time was devoted, by the engineer to the exploring of this section of the state, for the best site for a canal, and feeling confident from what knowledge I had of the face of this part of the country, that a summit-level could be found less elevated, I procured last summer a telescopic level, and spent a few weeks in taking levels, and making surveys to ascertain the relative height of the aforesaid swamp, in Champion, and a large swamp in Bloomfield; and also to see, if there were any streams, other than those above mentioned, that could be improved as feeders. The result of my examination was that the swamp in Bloomfield is eleven feet lower than the one in Champion. The

swamp in Bloomfield contains 1500 acres, and from which flow Rock creek, Centre creek, in Bloomfield, and Bankman's creek, in Bristol. I ascertained that Musquitoe creek, east of the Big swamp, is nine feet lower than the swamp, but I also ascertained that this creek by taking it out of its natural channel, near the north line of Green township, could easily be carried into the swamp, I merely state such facts, as have come to my knowledge, without attempting to make any comments, as not being a professed engineer, any opinion which I might give on this subject, might prove very erroneous—but this I think I can state with confidence, that the swamp in Bloomfield might very conveniently be converted into a large pond, or reservoir. This swamp is just 89 feet higher than Grand river, against the centre of Bloomfield. Musquitoe creek is a deep sluggish stream from its mouth up to the township of Greene, and runs through a flat alluvial soil. In taking the relative heights of the two swamps, for the sake of convenience, I pursued the turnpike to the state road, and up the road to Chocolate run, which takes its rise in the swamp, in Champion, and puts into the Mahoning at the Big bend, north of Warren. In examining my minutes, I find that the turnpike road, where it crosses Centre creek, in Bristol, is seventeen feet lower than Mr. Geddes's summit-level—at the time, my opinion was, that my survey was not sufficiently extensive to ascertain the fact, that the place in Champion where the waters divide, and run north and south, cannot be less than seven or eight feet lower than the first mentioned summit-level.

AN EXTRACT

From the Report of Mr. Geddes, relative to an examination of the country between lake Erie and the Ohio river.

[The notes in italics are made by Governor Brown of Ohio.]

Route by the sources of the Cuyahoga river, and Tuscarawas branch of the Muskingum river.

The waters of Tuscarawas and Cuyahoga divide in an extensive wet swamp, in the north end of which is a small lake, emptying its waters into the Cuyahoga. From the south end of the swamp small streams run into the Tuscarawas, which stream has a mill dam erected thereon, near the swamp. The bed of this dam corresponds almost exactly with that of the above lake.

The highest part of the swamp, above said level, is above 4 feet, and is elevated 404 feet above the level of lake Erie; and may be estimated at 428 feet above the level of low water, at the mouth of the Muskingum. It is probable that 6 or 7 feet of this summit might profitably be cut down to save lockage.

The Tuscarawas stream, and the waters of the little lake, in the swamp, is the only supply that, can *easily* be brought into the summit pond, here proposed. The furnace brook from the furnace pond, which is 16 feet above the level of the lake in the swamp may be brought; the most serious part of the expense being a *deep cut* near the furnace village. This deep cut would be in an open swamp, from both ends of which small streams issue. The deepest part of the cutting is 33 feet; and over a mile in length, from a depth of

six feet at one end to the same depth at the other end. From the west end of this cutting, the water would follow the natural channel of a brook to Faylor's mill pond, which is 11 feet higher than the little lake, in the swamp; and *between* said places, the ground is favourable for an artificial cut. But when done, the consequence would be ruinous to the many valuable hydraulic works, which are supplied with water by this excellent little stream. A lively little manufacturing village, at this place, would in a measure be made desolate. For this brook would be indispensable to the canal, almost the whole of the navigating season; the other aids being altogether insufficient alone.—There is another reason why the furnace brook ought not to be taken to feed the canal. In less than the third of a century, perhaps, the tonnage moving on this canal, would require more lockage water than could be supplied without resorting to the Cuyahoga river. And, as this river would be sufficient without the furnace brook, and affect the country much less by being diverted from its natural bed, it would be a better calculation to abandon the furnace brook for the Cuyahoga river in the outset. A feeder from this stream at Kelso's mills, in the township of Stow, as far as the furnace village, would be 7½ miles long, and pass over a country of most irregular formation; the sides of most of the hills as steep as the earth can stand; making it impossible to carry the feeder in any place along the *face* of them. A building *up* from the bottom, or cutting *down* from the top, would be indispensible, wherever the feeder ran on the face of these steep slopes. A very costly aqueduct must carry the feeder over the brook, in the furnace village, to make way for

which, some buildings would have to be removed. The top water line of this aqueduct would be 8 chains, 75 links long, and 28½ feet above the rocky bed of the brook. Excellent materials for building are on the spot and a fine rock foundation. In leading a canal from the *summit* to the mouth of the Cuyahoga river, difficulties of some magnitude must be encountered. The west side of the valley is the best, as there are but two places on this side where the river, running at the foot of high precipitous hills, would require the making of new channels for the stream, that the canal might occupy the present bed. Following the high land, on either side of the river, is rendered altogether impracticable, by the many deep ravines, through which every stream enters from either side.—The harbour at the mouth of this river, is spacious; and probably, can, for a moderate sum, compared with the object, be made safe, and easy to enter in all kinds of weather. The village here occupies a pleasant and healthy situation.

From the summit down the Tuscarawas valley, the shores are irregular, as far as the village called Newportage; thence down stream, following its east side, the ground is favourable, and the descent of the valley very moderate, for some distance; but after the junction of the Sandy creek, Sugar creek and Still water, the stream is enlarged to a river, with an increased descent, exhibiting in flood time, a boisterous torrent, overwhelming the low grounds, scooping them into hollows, and throwing them into heaps, rendering it altogether impracticable to make a canal on the alluvial bottoms, through which the river runs. From New Philadelphia downward the west side is the most

feasible. At Baker's mills, nearly opposite New Philadelphia, is a rocky point near five chains in length. The hill is high and rocks large, but the stone suitable for hewing. Above Schoenbrun one and a half miles, the river runs at the foot of a limestone hill, not high nor very steep, four chains long in one place, and in another three chains; thence pretty favourable until near Gnadenhuten, where there are ten chains of rocky precipice. Here the canal must be protected from the river flood by a stone wall, high enough to maintain the level of the plane below; over which the canal must pass, as considerable distance will be saved thereby, and much better ground obtained. A high point of clay hill, nearly opposite Gnadenhuten, will require the removal of many cubic yards to reach a yard forward. Nothing remarkably formidably exists between this hill point and Neighbourtown; and for two miles below, where commences a tract of two or more miles in length, remarkable for *slips*, some of the size of a quarter of an acre. "*Slips* are among the most formidable accidents to which canal works are liable, and can hardly be too much guarded against." Opposite White-eyes falls is a hill, not high, but stony. Extensive inundated flats lie at the junction of the Tuscarawas and Whitewoman, extending up to, and above the mouth of Mill creek, a short distance below which is the best plac for the canal to cross the mouth of Whitewoman.

Route by the sources of the Black river, and Killbuck branch of the Muskingum river.

The greatest depression in the ridge, which divides the Erie and Ohio waters, that can be found any where in the state, is at this place. A Cranberry marsh, surrounded by a border of wet timbered land, empties into the Black river by two streams, and also by one, into the Killbuck. This swamp contains 1400 acres, and the highest place in the Untimbered marsh, is elevated above the level of Lake Erie 337 feet; and to save lockage, may be cut down with advantage, perhaps to 330 feet. The valley of the Killbuck is, in many particulars, remarkably favourable to the project of leading a canal through it; the descent in the whole length of it is very gentle; and the low lands, which are almost every where wide, can but in few places be called *alluvial;* covered generally with beach and sugar maple. The inundations cover the flats but a few feet in depth, owing to their width, and the total absence of any large streams falling into the valley. Wide spread, and with a declivity so gentle, the floods move placidly along, threatening no disaster to any erections connected with the stream. The high rocky points, that in a few places have the stream running at their base, are shown on map No. 2. In these places, a new bed for the stream would be required, as the canal must occupy the place of the present water course.

The Black river runs in a *valley,* not unfavourable to the making a canal in it, until it reaches Rawson's mills, where the valley disappears, and the river makes its way through a bed, which it has scooped out of an extensive plain; and here the canal ought to leave the

stream and pursue on the east side, a route sufficiently distant from it to avoid the deep ravines, through which all the small lateral streams run as they approach the river. This distance from the river ought to be pursued to the lake, as the valley of the stream below the falls is very unfavourable for a canal.

A harbour for lake vessels, and canal boats, to meet in, and in the vicinity of which, a healthy and eligible site for a city may be found, will perhaps, with difficulty, be obtainable in the place where it would be wanted, in the event of a canal being made on this route.

To supply the *summit pond* of this canal with water, presents a difficulty, which is a great drawback on all the advantages enumerated. Nothing short of the Cuyahoga river can furnish a sufficient supply. To the expensive feeder required to bring water to the Cuyahoga and Tuscarawas summit, must be added a feeder from said summit to a branch of the Killbuck, as represented on map No. 2;* making a distance from the place of leaving the Cuyahoga river, to where the water would enter the canal, of near 50 miles! 39 miles of it an artificial cut. The 3¼ miles, preceding the entrance into the Killbuck branch, would be a deep cutting all the distance, in a wet swamp, the deepest part 13 feet, and may be estimated at an average of 10 feet for 3 miles. Allowing a bottom 15 feet wide, with a slope, to the sides, of 18 inches base, to 1 foot perpendicular, the cubic yards to be moved would be 175,977. Put this muddy excavation at 14 cents per cubic yard,

* This additional feeder commences at the Tuscarawas and Cuyahoga summit, and follows down the Tuscarawas valley, and up that of the Chippew outlet, and over to a branch of Killbuck.

and the amount would be $24.637. Set the remaining 26¾ miles, between this deep cutting and the Tuscarawas and Cuyahoga summit, at the ample sum of $5,000 per mile, making the sum of $133,750, and the whole 42 miles would cost—say in round numbers, $160,000. But notwithstanding the enormous cost of this feeder, this route will cost less than that of the Cuyahoga and Tuscarawas.

When it is considered that there is about 24 miles more canal to be made from the point of junction, on the Whitewoman, to lake Erie, following the Tuscarawas route, than the Killbuck route would measure; and that there are 134 feet more lockage on the former, it results that a first cost of much more than $100,000 would be saved, by making this very long feeder, instead of following the Tuscarawa and Cuyahoga route. The travelling forever, 24 miles further, and the time consumed in passing 16 extra locks, with the repairs of said locks, cost of toll houses, pay of lock keepers, &c. are subjects about the value of which the best informed might disagree; but the sum would be such as not to be lightly regarded.

From Coshocton to Zanesville, the valley of the Muskingum may be pronounced favourable; but from thence to the mouth of the river, most accounts agree in presenting it nearly impracticable to improve the navigation by a side cut. Locks and dams, as has been done on the river Schuylkill, will probably be the plan here pursued.

The surface of the Whitewoman, one mile below the mouth of Killbuck, is 148 feet lower than the level of Killbuck and Black river summit; considering said summit as cut down to within 330 feet of the lake Erie

level. This level of the Whitewoman may be preserved to the Great falls about the mouth of Tomaka.

Although a canal through either of the three routes above described, is practicable, one only can be made; the supply of water for all being from the Cuyahoga, which is insufficient for more than one.

Route by the sources of the Maumee and Great Miami rivers.

Near the road, about three miles north of fort Loramies, is the separation of the Maumee and Miami waters. The fall southward from the summit to the surface of Loramies creek at the fording place, is 29 feet. To the north the fall is more rapid, being 121 feet to the surface of the stream at fort St. Mary's. The dividing ridge, between St. Mary's river and the Auglaize river, is (on the road to Fort Amanda) nearly 100 feet lower than the summit; leaving no obstacle to the carrying a canal over into the valley of the Auglaize.

The Maumee and Miami summit is 399 feet above the level of lake Erie, and, with a little cutting down, may be made to correspond with the level of the mouth of Indian creek, on the Great Miami. There is reason to believe that a lower place than the one here mentioned, may be found on the dividing ridge.* It is most likely to be found west of the road. *Cutting down* here would not only save lockage, but lessen the long embankment at Loramies creek, and effect the taking in some valuable springs below the mouth of Indian creek. If the earth be found easy to move, 12

* *Found since, (not far west) a depression* 11 *feet lower.*

or 14 feet may be cut down profitably on this summit. The Loramies embankment, 29 feet high, would lose near half its height, and more than three-fourths its length. Passing the points of high land, between Loramies creek and Turtle creek, and between said creek and the Miami river, will require *deep cutting;* and Turtle creek probably a large embankment.

From the best accounts received of the durability of the Great Miami, there is great reason to hope that there will always be found, at the mouth of Indian creek, water sufficient to supply the summit-level of a canal. The difficulty of giving any descent to the water in a *feeder,* at that place, will require the cross section to be of such size, that it will necessarily be a *navigable* feeder; and if, from the practice of irrigation or any other casualty, water should ever fail in this canal, a copious supply can be drawn through a feeder from Mad river, as traced on map No. 3.* If it should be satisfactorily ascertained that the Great Miami will always be sufficient for this *summit pond,* the canal may be carried easier on the west side of the river through Piqua and Troy, as represented on map No. 3; but if this be considered doubtful, or it shall be found that the waters of Mad river will be needed in the upper level, then said level, supported on a high arch, should be carried on an aqueduct, over the Miami at the *high rocks,* three miles or so above the mouth of Loramies creek, and the same level kept up to the valley of Honey creek, there receiving the waters from Mad river into the *summit pond.*

* This feeder would leave the Mad river a few miles below the bridge west of Urbana.

The *high rocks* are masses of limestone reaching some chains up and down each side of the river, perpendicular, about 20 feet high, and nearly 100 feet apart. The river at this place would probably be full 50 feet lower than the canal level; and the embankments at each end of the aqueduct, of pretty formidable dimensions. A canal on this route will be longer than any of the others, and the amount of lockage much greater. Supposing the summit cut down to 383 feet above lake Erie level, and the descent to the Ohio, at Cincinnatti, estimated at 434 feet, it would make 817 feet of lockage. The adventurer, who is about to vest his funds in such stock, will wish to learn every thing relating to a formidable rival, the *Wabash* and *Maumee navigation*. From the levels taken, it results that the surface of the stream at fort St. Mary's, is but 278 feet above the level of lake Erie, and the fall thence to Fort Wayne, is variously estimated from 50 to 80 feet. Say that it is 48 feet, and 16 feet off for rising to the summit between the Maumee and Wabash; and said summit will thus stand but 246 feet above the level of lake Erie, 91 feet lower than the lowest summit in this state. It is a *cheap* navigation, but by no means a *perfect* one, that may be expected on these streams. A canal by the rapids near Fort Meigs, and a canal from Fort Wayne to the mouth of the Mississipawa, opens at the expense of a small sum, a communication between lake Erie and the Ohio river, considering its value, cheaper than any other that can be opened.

Route by the Sources of the Scioto and Sandusky Rivers.

These streams have their sources almost wholly in the country of *prairies,* than which a more unfavourable tract for the production of durable water does not exist in the state. Brooks impassable at one season, are totally dried up at another. These prairies once wet, rain can no more penetrate them than the roof of a building; it slides as effectually off them, and passes away into the rivers, leaving nothing but stagnant fens in time of drought.

In the broken lands, about the sources of the Whetstone, rise perennial springs, which are of sufficient elevation to be brought into the canal, proposed to be made here.

The Whetstone waters, after passing the mills of Mr. Royce on the east branch, and those of Mr. Mosier on the west branch, arrive in a tract so permeable to water, that very little in the driest seasons, reaches the mills of Mr. Cole below the forks: it will be, therefore, important that these streams be turned into an artificial cut, before they leave the tract of water-tight soil.

The great Miami has its source in a country, the formation of which, is very favourable to living springs.

The vicinity of Belle Fontaine and Solomon's town, is uneven oak land, a small tract of which produces so much water, that the Great Miami below Stoney point, is at all times a large stream, compared with the extent of country that it drains. By a level carried from Roundhead's town southward, it appears that the tract above described, is much elevated above

the prairie where the Scioto runs. Following the road southwardly, from Roundhead's town, thirty feet is immediately risen to an extensive table of land, over which branches of the Great Miami river run southeastwardly. The dividing ground between the Miami and Scioto waters is an extensive marsh, in which is probably mingled the waters of both streams.

The elevation above the Scioto, of the most northern stream of the Miami, is twenty-three feet, and the great marsh through which this stream runs, is probably, in its *highest* part, nearly on the same level. The next stream passed over (or main branch of Miami,) is above the Roundhead's town level thirty-seven feet, Cherokee run, remarkable for its durability, one hundred feet, and Col. M'Pherson's spring, ninety-three feet. This levelling shows with what facility the Miami main stream and Cherokee run may be turned into the Scioto, and that the most valuable branches of the Buckingelas, if needed, may in all probability, likewise be brought in. To get satisfactory knowledge of the facilities and difficulties attending the making of this *feeder* would require examinations, with the level, which would consume more time than could then have been properly bestowed on it. A further examination of this interesting object, ought to be at a time of low water, when the streams could also be guaged. The waters thus brought into this valley, will as it comes down the hill into the Scioto, make one or two good mill-seats, in a country to which nature has denied such benefits; and in the Scioto river below, advantages of the same kind will likely be realized. To make this plan perfect, an artificial channel must be

made to convey the water by the great marsh, which lies between Roundhead's town and Fort M'Arthur. Into this wide spread wet prairie the water is now diffused, and chiefly evaporated in a time of drought.

From information received as to the size and durability of these streams, it is highly probable that the additional supply of water that may be thus obtained, with the Sandusky, and with the proper management of the Whetstone waters, will be an ample sufficiency for the summit pond of a canal. All attempts to bring the waters of Mad river into the valley of the Scioto, have proved ineffectual. The extensive wet prairies, the sources of the Darby, Deer creek, the Little Miami, and the branches of Paint creek, lie on a high table of land, elevated generally about two hundred feet above the level of the Sandusky and Scioto summit. The rains which slowly percolate through the surface of these prairies, appear to produce copious springs in the valley of Mad river, and none in the valley of the Scioto, doubtless owing to the dip of the strata underlaying this high table.

The Grand ridge dividing the waters of Erie and Ohio, at the head of Sandusky and Scioto valleys, has its greatest depression at the head of a branch of the Tyamocte, the level of which is eleven feet higher than the mouth of Rush creek, and cuts the surface of the Scioto about three miles above the mouth of said creek. Notwithstanding the extent of level prairie, that must be dug through on the summit, there is little doubt that it could be cut down, perhaps eight feet, with advantage. The Scioto feeder would then start from the mouth of Rush creek with a small dam, taking in that little stream. The embankment over the

little Scioto, would be, by said cutting down, reduced to a mere trifle, and some valuable springs on the Sandusky, would be thus brought into the *summit pond*, and sixteen feet of lockage saved.*

The feeder from the Sandusky river, if the summit-level of the canal can be conducted as marked on Map, No. 4, will not exceed six or eight miles in length. A dam of eight or ten feet high on the river, may be necessary to collect and convey to the canal the valuable springs on the south or south-west side, above the Croghansville road. If it should unfortunately so turn out, that the ridge between the Sandusky and Tyamocte valley, by its elevation, would hinder the bringing the summit-level over it, short of Upper Sandusky or Negro town, this feeder would be expensively lengthened thereby. The Broken sword creek yields but little water in a dry time, in its present situation; but as a *dernier resort*, (for the expense would be great,) it may be made to bring the waters from Richland county, which spread themselves into, and are lost in the great marsh in a dry time, and in time of flood, run down the Broken sword and Honey creeks into the Sandusky, and by New-Haven down the Huron river. An artificial cut, carried along the south edge of this marsh, at the foot of the high ground from which the streams issue, would convey their collected waters to the Broken sword creek, after following the natural bed of which, to a proper place for the beginning of an artificial cut, this new stream might be conducted to the Sandusky river above the proposed dam. The *great marsh* is elevated above the level of the proposed summit, something over forty-six feet.

* *Summit here, above 360 feet higher than the lake.*

A level from Owl creek above Mount Vernon, has been carried down the north fork of Licking, and connected with the level brought from lake Erie down the Killbuck, and up to Newark; from which it results that Douglas's dam above Mount Vernon, is 430 feet above the lake Erie level.

A level from Newark, to the summit between the south fork of Licking and Little Walnut, makes that summit 346 feet above the Erie level. By taking the water out of Owl creek (as shown on Map No. 4,) it may, with some deep cutting, be carried over into the north fork of Licking; and about twelve miles above Newark, an artificial cut may be commenced, which will have sufficient elevation to convey these accumulated waters, through the valley of the south fork of Licking, over into the Little Walnut, carrying with them the Racoon fork; one of the most durable branches of that river.

This summit, at the sources of the Little Walnut and south fork of Licking, exactly corresponds, in elevation, with the Sandusky and Scioto summit, when the latter is cut down the 8 feet above proposed. Now if the country would admit of carrying a level canal between these two points, as traced on map No. 4, (and from the levels made, there is some reason to expect that it is practicable,) the Owl creek waters might be carried to Sandusky bay; bringing tributaries to the summit pond from Roundhead's town and from Mount Vernon; places nearly 70 miles apart in a direct line; laying under contribution, for feeders to this canal, the Miami, the Huron and the Muskingum rivers; besides the Scioto and Sandusky.

A *branch canal* might thus, without making any new summit, be carried to the Muskingum river. And when the mineral riches of that valley, in coal, iron and salt, are considered; likewise its hydraulic advantages, and every thing that can promote the growth of large manufacturing establishments, is it extravagant to say that such a branch would be well worth its cost, and that at no distant day? The fall from said summit to the mouth of Tomaka, is 197 feet. Owl creek is one of those streams from a hilly country, which are so remarkably durable.

A branch canal to the Muskingum, should the above prove impracticable, might be carried up the valley of the Little Walnut, from a level hereinafter described, as passing from Bigbelly by Circleville. This route would require 413 feet of lockage. A branch with all this lockage, might cost less than the above serpentine route.

From the summit to lake Erie, the country is very smooth, and even on the west side of Sandusky river. Tyamocte valley and Wolf creek present the only apparent difficulties; and these streams run so near the general surface of the country, that little is to be apprehended from them.

Water to supply soakage and evaporation in the lower levels, must be obtained by carrying down the first locks from the *upper pond* to a place in Sandusky valley, where water from that stream can readily be brought into the level below said locks. There are places, particularly at fort Ball, where the water from this river can be taken through feeders of no great length, into the canal. For the purpose of thus obtaining water, the canal cannot be led far from the river,

which ever side of the valley may be pursued. But if the canal is carried down the west side of the river, where will be the harbour for lake vessels and canal boats to meet in? The deeply laden canal boat cannot make its way through Sandusky bay; nor can the lake vessels come to Lower Sandusky. Conducting the canal to the mouth of Carrying river, has been proposed; to which it is objected that there is no suitable healthy situation there for the great emporium, that ought to grow up in such a place, and that there is no other way than carrying it down the Sandusky river, and along the bay to Portland. This will require examinations minute and extensive, as neither cheapness of execution, nor shortness of distance ought to stand in the way of placing said city in its proper place.

From the summit towards the Ohio river, all must be conjectural, or nearly so, as far as Columbus.

To carry the canal over the valley of the Little Scioto, in the place represented on map No. 4, will, doubtless, require a costly embankment; and it may be a better calculation to cross the valley much further up; although at the expense of adding some miles to the length of the canal.

As to the crossing the ridge, between the Scioto valley and Whetstone, or crossing that river, or the ridge between it and Allum creek, at the places where the canal is laid down, on Map No. 4, there has been no guide but the conjectures of persons acquainted with the country; and these conjectures may turn out to be very erroneous.

Bringing the summit-level of the canal over the ridge to the valley of Allum creek, would be very desirable

for the purpose of conveying water from said creek to supply the soakage evaporation, that may take place in the long level that, probably, will be carried down the west side of the valley of Allum creek towards Columbus.

The Allum creek like the Whetstone, loses its water in a porous soil, after leaving the uneven country, in which its sources spring; and if not drawn upon as a feeder pretty high up, will not be worth taking; and it is the only supply that can be obtained until the canal arrives at Bigbelly.

Another route may be found, the only practicable one, to wit: A route pursuing the valley of Scioto, and locking down occasionally, to situations, where *feeders* can be brought from the river to *replace water* wasted by soakage and evaporation. Following this route, it might be found difficult to conduct the canal to the plain, where the town of Columbus stands; the lowest part of which plain being 57 feet higher than the level of the river surface opposite. A very expensive aqueduct and embankment would probably be required for crossing the Whetstone, where its valley has become so wide and deep; expensive when compared with the crossing said stream at the place where the summit-level would pass over it. From Columbus southward, the canal ought to pass on towards the valley of Bigbelly, and cross it at, or above the point marked A, on Map No. 5. At this point the surface of the stream is as high as any part of the road, over the ridge between this stream and the Little Walnut. Therefore a *dam* may be used, if the making of an aqueduct be found inconvenient. The Little Walnut, at the post

road, is 39 feet lower than the level of Bigbelly, at A* and ought to be crossed with an aqueduct.

If the same level of the Bigbelly, at A, can be carried over the valley of the Little Walnut, (which above Miller's mill-dam, it probably may,) this level could then be pursued east of Circleville, over very smooth ground, to the valley of Sippo. The Sippo, Congo, and Blackwater valleys, will require expensive embankments and large culverts. The country from Kinnikinnik creek to Kilgour's plain, will present many difficulties on steep sidelying ground, particularly about half a mile in length of high precipitous hills at Hough's mills. A level high enough to pass over the plains at Kilgour's, must be commenced as far north as Kinnikinnik valley. This stream ought to be let into this level as a *feeder*. At Hough's mill pond, the river surface is 33 feet below said proposed level. Here the east bank of the river is a high perpendicular rock, of argillaceous slate; but this high level would pass altogether above the upper surface of the rock.

This difficult tract between Kinnikinnik and Kilgour's plain, may possibly be shunned by starting a level high up Allum creek, and carrying it over the summit between Kinnikinnik and Dry run. This would lead the tract of the canal far up the valley of Bigbelly and Little Walnut; and in all probability, greater difficulties would be encountered, than those sought to be avoided.

The surface of Kilgour's plain being gained, all is favourable as far as Salt creek. This creek will be crossed by an aqueduct and embankment, probably of

* In section 33, township 4, range 22.

considerable magnitude, when all is easy to Carr's run, where will be required a large culvert and a pretty large embankment. Nothing worthy of the name of a difficulty now occurs before the arrival at Sergeant's mill. Here the river runs for 15 chains at the bottom of a steep high hill. By carrying the level of a pretty high embankment at Carr's run on to this plain, the hill will be easier cut down from above, than if passed with a lower level. No more such instances occur between this and Portsmouth; several brooks are to be crossed, the most notable are Beaver brook, M'Konnel's run and Kroniger's run, all of which are formidable in time of flood, and yield little water in a drought. A supply of water may be taken into the canal at Salt creek, but an additional supply ought to be had between Piketon and Portsmouth. The streams from the hills are numerous, and if each would afford but a little water, a sufficiency might be calculated upon; but it is said that many of them dry up altogether every autumn. To take a feeder from the Scioto river may be found feasible.

Both Sandusky and Scioto valleys may be pronounced favourable to the conducting of a canal along them, when compared with the valleys of most other rivers; and *very* favourable when compared with the valley of the Mohawk, in the state of New-York.

The particular advantages possessed by said valley, is the facility with which the canal in most places may be led along on a level, altogether above the alluvial bottoms on the margin of the rivers, entirely secure from floods, so menacing to the canal works on the Mohawk river. The total absence of large lateral rivers, is an advantage worthy of note: the Bigbelly, Little

Walnut, and Salt creek, being the *most* formidable; each of which drains comparatively a small tract of country.

The summit pond, on this route, when cut down as proposed, will be 346 feet above the level of lake Erie, and 447 feet above the level of low water mark at the mouth of Scioto river; making the whole lockage 793 feet. Following the meanderings of the valleys on a map the distance is 207 miles from the mouth of the Scioto to the mouth of Carrying river; and a canal might possibly exceed this distance but very little.

All which is very respectfully submitted,

By your humble servant,

JAMES GEDDES, *Engineer.*

December, 1822.

Extract of a letter from Thomas Wilson, esq. relative to a canal by the way of Allegany river, &c. to Lake Erie.

ERIE, (Pa.) Dec. 1, 1823.

SIR,

"The only recent additions that have come to my knowledge are, the able and intelligent report of Mr. Geddes, of the actual surveys taken by himself in Ohio, and a recent examination by commissioners appointed for that purpose last winter, in Pennsylvania, west. The former report you have probably seen, it was published in most of the Ohio papers in May and June last; by this report, it appears that the best route between the Ohio river, and lake Erie (excepting only that of the Miami and Wabash,) is by Big Beaver and Cuyahoga, and their interlocking branches.

The examination by the Pennsylvania commissioners, is not yet published, nor is it completed: those commissioners have, however, pretty well ascertained one material fact, that there are two routes in Pennsylvania more favourable than any reported upon in Ohio. These are both from the head of Ohio, at Pittsburg, by the Allegany and French creek, to the mouth of the outlet of the Conneautte lake, 10 miles below Meadville, (about 48 miles from this town;) from this point two routes have been examined, one by the said Conneautte lake, and by a deep cut for a short distance to the head of Elk-lick creek, and down the same to the lake; then to the end, without a harbour, or proceed down the lake 18 miles to this place. By this route, the lockage appears to be greater than by one mentioned in Ohio, by nearly one hundred feet; but the supply of water is inexhaustible, consisting, among other waters, of the whole of French creek, at Meadville, where it well deserves the denomination of a river.

The other route from the same point proceeds up the valley of French creek to Waterford, 15 miles from this place; then by a canal up the Le Boeuf creek, and across the dividing land to the valley of Walnut creek; and from thence about four miles from Erie, turns into the valley of Mill creek, which it leaves again on the approach to this town, and runs by a natural ravine into the basin of *Presque Isle.* On this route would be a greater lockage than on that last mentioned, the height of land being greater by 160 feet; but the supply of water would be still deemed sufficient, depending however on a feeder to be brought about two miles from the fork of French creek above Waterford. This has the advantage of being an easy route, either by

the canal or the natural stream to Waterford, and of a short portage, if it should be deemed expedient to substitute this for the continued water carriage, rendered expensive by a great lockage."

Extract of a communication from Judge Ruggles, of Ohio.

[Originally published in the Western Herald.]

I have read with great satisfaction, a communication in the National Intelligencer of July 12th, on the subject of the Chesapeake and Ohio Canal, signed by Isaac Briggs. This able and intelligent gentleman, this experienced engineer, deserves the gratitude of his country, for his attempt to carry into execution this great national work. Should his views be realized, and a canal be made from Washington city, by Cumberland, to Pittsburgh, besides the important advantages that would result to the states through which it would pass, I consider it would be highly advantageous and beneficial to the great interests of the Union, by connecting the extreme parts with the centre, and by building up the capital of the United States, in which all ought to feel a common interest. The vast and lucrative trade that would be carried on in this channel of commerce with the western country, provided it was completed, would not be solely beneficial to Washington, but would be equally so to Baltimore, by the cutting of a lateral canal from the valley of the Potomac to that city. I cannot permit myself longer to doubt, but that the rich and enterprising citizens of Maryland, so great a portion of whom are directly interested in the execution of this work, and also of Bal-

timore itself, will see their future interest and prosperity in the accomplishment of this important measure. Should Maryland co-operate with Virginia and lend her aid and resources to construct a canal from the tide water of the Chesapeake to the Ohio river, she may confidently expect to see the trade of the country lying upon the Ohio and its tributary streams above the falls at Louisville, flow in this channel to an Atlantic market. Nor would this be the limit of the country that would pour its wealth and trade through the same channel. An extension of the canal from the Ohio river, commencing at some point between Pittsburg and Stubenville, to the southern shores of lake Erie, striking the latter at the most eligible point between Cleaveland and Harpersfield,* would give to this channel of commerce, if not a monopoly of the four great western lakes, it would at least give to it an equal and fair participation in that trade. If this be a fact, and I shall attempt to demonstrate it, is it not an object of so much value and importance, as to claim the serious consideration of the community? Is it not a prize worthy the most candid attention of the citizens of Washington and Baltimore?

I think Mr. Briggs is mistaken, (with great deference to his opinion, however,) when he says, *"nature,*

* I will designate more particularly the route which I suppose would be the most eligible. From Washington along the valley of the Potomac, to Cumberland; from thence, across the mountains, by the aid of the waters of Savage creek and Deep creek, to the Youghagany; thence, down the same to the Monongahela, following the latter stream to Pittsburg. From this place along the margin of the Ohio river, to the mouth of the Big Beaver; thence, up the same, till the waters of the Mahoning fall into it; thence along the Mahoning, across the dividing ground to the waters of Grand river; thence, down or near the same, to its mouth at Painsville, on the lake. Whoever casts his eye upon the map, will perceive that the course of these streams is in almost a direct line from Washington to the lake.

and the enterprising spirit of her own citizens, have given to New-York, *beyond competition*, in addition to her own internal trade, which is very rich, the trade of St. Lawrence river, that of an immense extent of lake shores, and of the northern parts of the states of Ohio, Indiana, and Illinois, as far as the ridge separating the waters that flow into the lakes, from those that flow into the Ohio and Mississippi rivers." I am willing to admit, that the enterprising spirit of the citizens of New-York will secure to that state the trade and wealth of those vast regions, unless similar exertions are made in another quarter. But instead of *nature's* having given to New-York the trade and commerce of those lakes, I mean Erie, Huron, Michigan, and Superior, I think she has offered it to Virginia and Maryland. The relative positions of those lakes to the Atlantic cities will go far to strengthen this assertion. The cities of Washington, Baltimore, and Alexandria, are at least one hundred miles nearer lake Erie than New-York. From Cleaveland to Washington is about three hundred and sixty miles—from Buffaloe to New-York, cannot be less than four hundred and sixty miles, by the way of Albany, the course of the canal. This calculation relates simply to lake Erie. What would be the situation of those two canals, if they were constructed with regard to the trade of the three north-western lakes, Huron, Michigan, and Superior? Boats or vessels, bearing the produce of the countries bordering upon those lakes, must all pass through the Detroit river, and by the city of that name. Those boats or vessels, therefore, would made Cleaveland, the supposed termination of the Chesapeake canal, with two hundred miles less sail than they could reach Buffaloe, the termina-

tion of the New-York canal. This, added to one hundred miles, the advantage which Cleaveland has over Buffaloe, as before mentioned, gives a difference in distance in favour of Washington and Baltimore over New-York, for the three north-western lakes, of three hundred miles. This difference in distance would be sufficient to counterbalance any additional labour or expense that might be incurred in making and navigating the canal across the mountains. Add to this the fact, that the Chesapeake canal would be open for navigation earlier in the spring, and later in the fall, in consequence of its more southern latitude—and I think it would not be unreasonable to conclude, that Mr. Briggs was mistaken, when he said that *nature* had given to New-York, *beyond competition*, the trade of those lakes, and of the northern parts of the states of Ohio, Indiana, and Illinois. My opinion is, that *nature* has offered to the inhabitants of the Chesapeake an equal, if not an advantageous participation in that trade.

[After some remarks relative to the practicability of the project, the writer adds:]

From the foregoing remarks and extracts, it will appear, that the obstacles which have hitherto been considered insuperable, to a canal navigation across the mountains, have been entirely removed. I trust there is spirit, enterprize, and capital sufficient, in that portion of the country which will be benefitted by it, to commence and complete the work.

The next question that presents itself is—The policy of continuing this canal from the Ohio river to the lakes, as one regular connected channel of commerce. During the present summer, Judge Tappan, chairman of

the Ohio Canal Commissioners, a gentleman of science and considerable experience, has explored the route heretofore mentioned in this communication, and found that no difficulties oppose themselves to the execution of such a work. The country is level, and the water abundant. The public may expect an interesting report from this gentleman, at the next session of the Ohio legislature, on this subject. The distance between the Ohio river and lake Erie, at the nearest point of approximation in this direction, does not exceed 90 miles.* It is therefore evident, that a canal can be made with great ease, and at a moderate expense. I have before examined the relative position and distance of New-York, Baltimore, and Washington, from the four north-western lakes, by which a difference of distance was found in favour of the two latter cities, of three hundred miles, sufficient, in my estimation, to turn a great portion of the trade, if not all of it, in that direction. This question early occupied the mind of the great Washington, and from his publications concerning it, it appears that he confidently anticipated that the period would arrive when the commerce of the lakes would take this course to the ocean. His manuscript calculations make a difference between the route from Detroit to Alexandria, and that to New-York, of 496 miles.

The great advantages and benefits resulting from the accomplishment of such a work, must be obvious to every one. It would furnish an outlet to the rich agricultural productions of the west. Every article reared

* The expense of making the canal from the Ohio to the lakes, has been estimated by a gentleman of considerable experience, at 700,000 dollars.

by the labour of the farmer would receive an additional value of 40 or 50 per cent. The produce of the rich and extensive mines of lead and copper on the borders of the northern lakes, so necessary in ship building, and in carrying on the operations of war, would float in the same direction, and find a market in the centre of the union. The furs and peltries taken on the great lakes, and the upper Mississippi, would find their nearest Atlantic market on this route—while the productions of foreign commerce, wafted to our shores from all parts of the world, would, in return, with great facility, cheapness, and expedition, be distributed through this vast interior.

I have presented this subject to my countrymen, with a hope that it will receive a candid and dispassionate discussion. It is my intention, in a future number, to make an estimate of the whole distance of the canal, and a calculation of the expense of making it, together with the price of freight per hundred, from the lakes, and from the Ohio river to Washington and Baltimore.

AN OHIO FARMER.

The following letter as containing some highly interesting suggestions, relative to the proposed canals, regarding them in a military point of view, cannot fail to be read with a great degree of interest. The source from which they have emanated, entitle them to the highest consideration and respect—it is regretted that this communication was not received at a sufficiently early period, to have given it a more prominent place in this work.

Letter from General Thomas J. Jessup, Quarter Master General U. S. Army.

Washington City, *January* 16*th*, 1824.

Sir,

Your letter requesting my views in relation to the military importance of the proposed western canal, was received some time ago; but in consequence of the weak and diseased state of my eyes, and the attention, which my official duties required of me at the close of the year, I have been prevented from replying to it at an earlier date.

How important, soever, internal improvements, such as roads, canals, and bridges, may be in a political and commercial point of view, I am persuaded they will be found to be still more so in their relation to the military defence of the country; for the military power of a nation consists not so much in a numerous population and great resources, as in the capacity which it possesses of concentrating them at assailable points, with certainty and rapidity. If this proposition be true, and I hold it to be undeniable, it inevitably follows that the nation having the best system of internal improvements, all other circumstances being equal, will be more powerful than any other, particularly in wars of defence, because it can place at any point on the frontier a greater force, and a larger portion of supplies, in a given time, than its antagonist.

The military power of contiguous nations of equal force, is in proportion to the rapidity with which that force may be concentrated—for instance, if one move its troops to the point of action, at the rate of forty miles a day, and the other at twenty, it is evident, that

the former may on all occasions operate with a force double to that of the enemy—and the whole secret of success in war, as well as in politics, consists in being able to oppose the many to the few.

If nations thus situated be able to concentrate equal forces in the same time, that which can accomplish the movement with the least fatigue to its troops, will beat the other, for its force will arrive on the ground better prepared for action, and may gain the victory before its enemy be sufficiently refreshed to make a vigorous defence.

From experiments made by this department on the New-York canal, it has been ascertained that troops may be moved without fatigue, and with all their supplies, at the rate of fifty or sixty miles in twenty-four hours. Now, the experience of service proves, that the greatest average march of a column by land on the best roads, will not exceed twenty miles a day—and if a movement be continued at that rate for four or five days, the troops employed would require a considerable time for repose, before they would be fit for efficient service in the field. It consequently follows, that canals, as a means of military concentration, are preferable to even the best turnpike roads; for *they* enable a nation possessing them to concentrate its force with more certainty, rapidity, and with less fatigue, than could be done by any other means whatsoever.

If, for instance, this city were menaced with an attack, as during the last war, the government, unless it should have an army permanently stationed here, for defence, would be compelled to rely on the militia within twenty or thirty miles of the city. And even, if that force were brought together, it would be almost

impossible to supply them with provisions, and other necessaries by land transportation. But, if the proposed canal were completed, the whole force and means of the country from this city to the Ohio river would be available, and could be brought to the point of action with less fatigue to the troops, than would be produced by one day's march. And those assembled, certain of reinforcements and supplies, would feel more confidence in themselves, and consequently be better soldiers.

If the canal were continued to Baltimore, Philadelphia, and New-York, the whole disposable force and supplies of the immense region depending upon those cities, might be used in the defence of any point from Norfolk to New-York.

Should this scrawl afford you a single useful hint on the subject, so interesting to us all, I shall feel much gratified.

Wishing success to your patriotic exertions,

I have the honour to be, with great respect,

Sir, yours, &c.

TH. J. JESSUP.

Mr. Shriver.

APPENDIX.

CANALS OF NEW-YORK.

The following brief view of the Canals of New-York will be found to possess much interest and information. The great and stupendous work, the *Erie Canal*, was commenced on the 4th of July, 1817. It is about 363 miles long, and it is now all finished excepting 30 miles at its western extremity, from Lockport to Buffaloe. It has 81 locks, constructed of solid masonry, viz. 29 from Albany to Shenectady; 25 from the latter place to Utica; 25 from Utica to Rochester; and 5 from Rochester to Buffaloe. The *Northern* or *Champlain canal* was begun on the 10th of June, 1817, and is completed.—Its whole extent is about 62 miles, and it has 21 locks. In this enumeration, two locks to communicate with the Hudson river at Troy the great sloop lock above Troy; five ascending locks at Lockport, and all the guard locks, are omitted. There are also several aqueducts of great length. Those over the Mohawk, between the Cahoos and Shenectady; that at the little Falls, and one over the Gennessee river in particular. Several dams are also connected with the work, viz. 5 over the Hudson river; 1 over the Mohawk, and 1 over the Tonewanta creek. A latera canal of one and a half mile, from the Erie canal to Salina, was completed in 1820, and several feeders have been constructed, some of which are navigable, and a great number of substantial bridges.—The column of water in each canal is 40 feet wide at the top, 28 at the bottom, and four feet deep. The locks are

90 feet long, and 14 feet wide in the clear. A boat of 25 tons is considered a full load for one horse, and 25 miles travel, a day's work. If above 25 and 50 tons of freight are in the boat, two horses are used, and they travel 25 or 30 miles a day. Those boats that have been built expressly for the canal, will generally carry from 30 to 45 tons; but it is supposed that vessels may be used carrying 100 tons. The transportation of a ton of flour from Buffaloe to Albany, will not cost more than ten dollars—freight and toll included; by land it costs 100 dollars, or thereabouts. The tolls for salt and gypsum are 50 cents per ton for 100 miles. For produce of the country, $1.50; for merchandize, 5 dollars. The revenue from tolls, was last year about $65,000; this year it will be $100,000.

All the canal loans have been negotiated in the state of New York, and the whole amount now is about $2,813,500 in stock, some 5 and some 6 per cent interest, &c. reimburseable in 1837 and 1845.—The annual interest is about $300,000, and the whole sum expended to this time, is about $6,587,826.

Baltimore American.

MIDDLESEX CANAL.

The Middlesex canal was cut from Boston harbour to the banks of the Merrimack, below Chelmsford. The canal commences above Patucket falls. It is carried over, and on the level of Concord river eleven miles, and thence down the sloping intervening ground to Boston harbour. The whole length of this fine canal is 29¾ miles, it has an entire fall of 107 feet by thirteen locks. The canal is 24 feet wide, with a depth of 4 feet. The locks are 90 feet by 12, and of excellent masonry. Another canal has been cut around Patucket falls, in order to connect the navigable water above, and the Middlesex canal with the tide water below. The Patucket canal does not reach tide water, but below the falls the stream though rapid is navigable, and in 45 miles falls 36 feet, and reaches the tide at Haverhill. Above the outlet of the Middlesex canal there are

three other short cuts at several places. The Bow canal occurs first below Concord, is followed 6 miles still lower down by Hookset canal; Amoskeag canal was made 8 miles below Hookset; and in 9 miles below the latter six short cuts have been made round as many rapids or falls. Cromwell's falls have also been passed by a canal 14 miles below Amoskeag, and 15 miles still lower is the Wicase, the last above that of Middlesex. *Darby's Ed. Brooke's Gazeteer.*

The boats of transportation on this canal carry 14 tons, and are drawn by a horse 3 miles an hour. Packet boats pass the whole length in five hours coming down, and seven going up being about at the rate of 5 miles coming, and a little more than 3 miles going. From the summit-level down there is a current of half a mile per hour, the fall in each mile is one inch. The water supplying the Middlesex canal, on the side next Boston flows from the Concord river through a horizontal aperture of 6 feet by 1, with a head of 2 feet water above the upper side of the aperture. *Brewster's Ency.*

A Table of the principal Canals of England; with their length in miles, and rise, and fall in feet, &c. from the maps of Smith, and Philips's work on Inland Navigation.

Names of the Canals.	L'gth. miles.	Rise, feet.	Fall, feet.	Cost, *L.* Sterling	No. of tun'ls	Length of tunnel mls. yds.
Aberdare, - -	7½	40		33,500		
Aberdeen, - -	19	170		50,000		
Andover, - -	22½		177			
Ashby de la Zouch,	30¼	140	84	200,000		
Ashton, - -	7	152				
Barnsley, - -	14½		120	97,000		
Basingstake, -	37	195		186,000		
Birmingham & Fazely,	16½		228			
Brecknock, - -	33	68		150,000	1	220
Caledonian, -	60½	90	94			
Chester, - -	17½		171			
Chesterfield, -	40	45	335	100,000		
Coventry - -	27		87			
Crinian, - -	9	58	59	180,000		

Names of the Canals.	Length miles.	Rise, feet.	Fall, feet.	Cost, *L.* Sterling.	No. of tun'ls.	Length of tunnel mls. yds.
Cromford,	14½	80			1	1 1240
Croyden,	9	150		80,000		
Dearn and Dove,	9½	125		100,000		
Derby,	17	29		90,000		
Dudley,	10½		85	130,000	2	2 340
Duke of Bridgewater,	35		84		1	4
Ellesmere,	57	228	380	400,000	2	1262
Erewash,	12	181				
Forth and Clyde,	35	155	156	300,000		
Grand Junction,						
Brentf'd & Braunston,	93¼	567	229			
Paddington,*	101¼	457	229	1,125,000	3	2 1200
Grand Union,	23¼	54	76			
Grand Trunk,	93	316	326			
Grantham,	30	148		129,000		
Hereford & Gloucester,	36½	195½	30	30,000	1	1 432
Huddersfield,	19½	335	436	276,000	1	3 1540
Kennet and Avon,	57	211	402	710,000	1	2 888
Kingston & Leominster,	45½	496	48			
Lancaster,	76	422		614,100		
Leeds and Liverpool,	117	431	410	540,000	1	1633
Leicester,	21½		45	84,000		
Loughborough,	9½		41			
Manchester to Bolton and Burg,	15	187		67,000		
Manchester & Oldham,	11	152		170,000		
Monmouthshire,						
Newport,	11	447		319,385		
Ebroy,	12	358				
North Wilts	8½		59			
Oakham,	15½	126		106,000		
Oxford,	91½	195	74			
Rochdale,	31½	338½	275	391,000	1	1 1320
Sankey,	12½	78				
Severn,	178	225				
Shrewsbury,	17½	155		70,000		
Shropshire,	7½	332	120			
Somerset,						
Dunkerton,	8	138				
Rodstock,	7½	138				
Stafford & Worcester,	46½	294	100			
Stratford on Avon,	23½		209	225,000		
Stroud,	8		102			
Swansea,	17½	336		60,000		

* Same canal.

Names of the Canals.	Length miles.	Rise, feet.	Fall. feet.	Cost, *L.* Sterling.	No. of tunl's.	Length of tunnel mls. yds
Thames & Severn,	28¾	129	241	225,000	1	2 880
Trent, - - -	100		86½			
Union, - -	22½		175	300,000	4	1 1160
Wilts and Berks, -	52	165	211	311,900		
Woscester and Birmingham, -	29		428	399,929	1	1 880
Wysely and Essington,	24	270				
Branches, -	10	276				

Extract from an article in an Ohio paper by Mr. A. Bourne.

In China, the principal commercial cities are situated nearly in a line from north to south, parallel to the sea coast; and as the general course of the navigable rivers is from west to east, intersecting the principal line of commercial intercourse at the right angles, the Chinese at a very early period began to open an artificial navigation by means of canals, in the line of trade. The grand trunk from Pekin to Canton, is, with its windings, about 920 miles long, and 120 feet wide, and from thence there are numerous branches in all directions.

The rivers also, are nearly all of them rendered navigable as far as they afford water enough (when confined to the most convenient shape) to float a boat. They have no locks on their rivers and canals to pass the boat from one level to another; but use sluices and inclined planes, up which the boats are hauled by manual labour, assisted, in most instances by capstans and other mechanical powers. It appears to be the policy of the government to find as much employment for the great population of the country in these hydraulic operations as possible; and perhaps, this is the reason why no locks and other labour-saving facilities have been used—and the reason why the canals are not continued quite into the city of Pekin, but the goods are all carried a short distance by porters. The emperor's barks or canal packets, are 70 feet long, 16 feet wide, and 11 feet high—containing a hall, four rooms and a kitchen; and are very regular in their arrivals at, and departures from the different cities on their route.

The aggregate length of the canals and artificial river navigations in China, is about 5,000 miles; and the particular management of the waters has been recorded in books for the last 1800 years.

In India there are some canals, which like those in Egypt were constructed principally for irrigation, but are also used as channels of commercial intercourse.

In the region of Delhi, there was a considerable tract of country which was barren and uninhabited, because there was no water; until a prince of more observation and less indolence than his predecessors, constructed a canal about 60 miles long, from the river Jumna through this barren tract towards his capital. From the main canal many branches were made in various directions to water the land, which soon became productive and well peopled; adding greatly to the wealth and power of the prince, who became very popular in consequence of this measure.

The total length of the Indian canals is estimated at 250 miles.

In Greece, we find no canals.—Perhaps the peculiar situation of the country, being mountainous and deeply indented with bays and good harbors, around which the inhabitants chiefly resided, together with the continual warfare with their neighbours, rendered artificial navigation unnecessary or impracticable; but it appears very extraordinary, that a country in which the arts and sciences generally arrived to great perfection, should exhibit so few hydraulic works.

In Italy, the aggregate length of the canals is about 140 miles, besides a great number of small rivers, which are rendered navigable by means of dams, locks and sluices. The first lock was make by a Venetian in 1481; and previous to that time the boats in canals were passed with great difficulty and some danger from one level to another by means of sluices and inclined planes. At Milan, there is a canal consisting of the branches, in all about 26 miles; it is 130 feet wide at the top, 46 feet wide at the bottom, has 11 sluices, and is the largest canal in Italy.

Holland exhibits the most astonishing proofs of patient industry in the construction of hydraulic works. The whole expense

of these works is estimated at 300,000,000 pounds sterling; and if we deduct three-fourths of this amount for the expense of constructing the dykes, sea-gates, &c. the balance would be sufficient to make 10,000 miles of canal at $30,000 per mile. Besides the regular canals which traverse the country in all directions, the inhabitants have dug out and wholly excavated the earth in many places for peat or turf, to the depth of 16 or 18 feet, and for the space of several square miles, from one to 18 or 20, and this depressed surface is called a polder. As the surface of the ground is nearly on a level with the ocean and the large rivers, the polders are protected from inundation by dykes; around which, on the outside, is a canal called a ringsloot, into which the water is raised from the polder, is drained, rendered fit for cultivation, and supports a great number of inbabitants.

In France, the aggregate lengths of canals is about 528 miles, including 1¼ miles of tunnels. The canal of Languedoc is 148 miles long, 64 feet wide at the top, 34 at the bottom, and 6½ feet deep; having 114 locks, 55 aqueducts and culverts, and 92 bridges. The feeder of the summit-level is 28½ miles long 12 feet wide, and 3 feet deep. This canal was made for the passage of sea vessels from the Atlantic to the Meditteranean.

In Germany, the total length of canals is about 80 miles.

In Prusia, about 120 miles.

In Russia, about 200 miles.

In Sweden, about 200 miles.

In Denmark, about 50 miles, which is the length of the Holstein canal. It is 100 feet wide at the top, 54 feet at the bottom, and 10 feet deep; it is navigated by sea vessels, about 2,500 of which pass annually.

In England, there are 113 canals, the aggregate length of which is more than 2,450 miles including, 33¼ miles of tunnels, having 15,000 feet rise and fall, and requiring 1500 locks at 10 feet lift.—The artificial river navigation, rail ways and inclined planes, are supposed to be equal in total length to the canals.

In the year 1759, the Duke of Bridgewater commenced the first regular canal in England.—It is 45¾ miles long, including ¾ of a mile under ground at his coal-mines at Worsley, and carried on one level at great expense, except where it locks down

to the Mersey 82 feet. The tunnel in the hill is 6 feet wide and 5 feet high, expanding at several places for boats to pass, and is arched with brick, where there is not rock or coal, having several air shafts to the top of the hill, in some places 110 feet. This canal crosses the river Irwell on a stone aqueduct of 3 arches, 38 feet above the water in the river, admitting vessels to pass under it with their masts standing.

In Scotland, there are 7 canals, the aggregate length of which is 135½ miles, the whole rise and fall 1019 feet with 123 locks. The Caledonian canal is 21½ miles long, (exclusive of the lakes which occupy 38½ miles of its course) 120 feet wide at the top, 50 feet wide at the bottom, and 20 feet deep. It has 29 locks from 170 to 180 feet long, 40 feet wide, and 20 feet deep. This canal is carried on an embankment 400 yards into the sea to obtain a sufficient depth of water, having a basin 967 by 162 yards, and is in dimensions and workmanship the greatest canal in the world.

In Ireland, the whole extent of the canals is about 206 miles, rise and fall 894 feet, with 109 locks.

In 1759, when the duke of Bridgewater finished his canal in England, there was not another in that empire; in 1806, there was completed 245; and legislative provision made for 57 others; 22 of these united the waters of the east and the west, crossing a mountain, which separated that country, as the Alleghany did this. Thirty-two miles were entirely subterraneous. To destroy these canals would be to cut the veins which give circulation to the life's blood of that powerful nation. France had not been inattentive to this important subject; she had made many canals at a great expense. Upon one she had expended more than twelve millions of dollars. Other governments had been even more provident. Claudius, one of the Roman emperors, it was said, had employed 30,000 men for twelve years, upon a single canal: and Holland, scarce half as large as some of our states, had expended upon canals, £300,000,000, more than double the whole amount of the expenditures of this government since the formation of the Constitution.

Extract from a speech of Mr. Stewart in Congress.

Prices of Canal stocks in London, October 26, 1822, *taken from the European Magazine for October* 1822; *to which is added the length of each Canal, &c.*

CANALS.	Share.	Selling price.	Annual div.	Length.	Fall.
	£	£	£	miles.	feet.
Barnsley,	160	200	10	15	120
Birmingham,	25	580	24	(a branch.)	
Chesterfield,	100	120	8	46	380
Coventry,	100	1070	44 3	33	
Cromford,	100	270	14	18	
Derby,	100	140	6	9	
Erewash,	100	1000	58	12	108
Forth and Clyde,	100	470	20	35	
Grand Junction,	100	245	10	94	587
Leeds and Liverpool,	100	365	12	130	840
Leicester,	100	300	14	14	
Loughborough,	100	3500	170	9	
Milton Mowbray,	100	222	11	—	
Monmouthshire,	100	170	8	18	
Neath,	100	410	25	4	
Nottingham,	150	200	12	15	
Oxford,	100	730	32	91	
Shrewsbury,	125	170	9 10	18	
Somerset Coal,	50	170 10	7	18	
Stafford and Woostershire,	140	700	40	47	294
Stourbridge,	145	200	9	—	
Stroudwater,	145	495	22	8	108
Swansea,	100	185	10	18	
Trent and Mersey,	100	1710	75	93	594
Warwick and Birmingham,	150	230	11	25	
Warwick and Napton,	100	210	10	15	

Supposing one person had originally one share in each of these companies, they would have cost him $9878—which, if they were disposed of at the present price, would produce $62,473.40, or about 600 per cent, after having received dividends for a number of years—taking which, at the above rates, will average about 30 per cent annually on the par value of the shares.

Under the head of Canals, in Rees's Encyclopedia, it will be seen that nearly the whole of the above named Canals were made, and are principally used, for the transportation of coal.

Extract from a Speech of Mr. Mercer to the late Canal Convention.

TABLE

Exhibiting a view of the various states and territories, watered by the Ohio, Mississippi, and Missouri, and their tributaries with an estimate of the quantity of territory, watered by each; from Melish's Geographical Description of the United States.

	Square miles.
Missouri territory, ¾	698,000
Missouri,	60,300
Arkansas territory,	121,000
Louisiana, ¾	36,000
North West Territory, ½	72,000
Illinois, 99-100	58,310
Indiana, 19-20	34,940
Ohio, 4-5	30,800
Pennsylvania, 1-3	14,650
New-York, 1-100	460
Maryland, 1-100	110
Virginia, 2-5	25,600
Kentucky,	39,000
North Carolina, 1-50	900
Tennessee	41,300
South Carolina, 1-150	200
Alabama, 1-7	7,250
Mississippi, ½	22,670
Total,	1,263,870

Being considerably above two-thirds of the whole United States territory.

The waters of the Arkansas, and Red river, extend into the internal provinces of Santa Fe, and it is presumed, that part of the waters of the Missouri extend beyond the 49th parallel of lattitude. The territory occupied by these two items, will be about 130,000 square miles, making altogether nearly 1,394,000 square miles, viz.

Valley of the Missouri,	674,000
Valley of the Mississippi above the mouth of Ohio,	225,000
Valley of the Ohio and its waters,	105,000
Valley of the Mississippi and its waters below the mouth of Ohio,	290,000
	1,394,000

THE END.